INTEGRATION OF ARTIFICIAL INTELLIGENCE IN THE RISK MANAGEMENT PROCESS: AN ANALYSIS OF OPPORTUNITIES AND CHALLENGES

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Abstract
Enterprise risk management is a critical component in achieving long-term performance in any company seeking to achieve long-term results. Businesses face a variety of internal and external risks over time, some of which are more difficult to manage or eliminate than others. Recent times have shown that technological progress can have a significant influence on all industries. Artificial intelligence is a topic that is relevant today, given the advancements in the field and the increased interest from the public. We already know that many people are worried about artificial intelligence, particularly since this aspect has the potential to affect millions of people's careers in finance and accounting. Nonetheless, if used appropriately, this risk might benefit people and should not always be seen negatively. The article examines how artificial intelligence can be incorporated into risk management procedures, with an emphasis on the accounting and financial domains. The use of artificial intelligence in the analysis of vast volumes of financial data and the successful detection of anomalies, which improves risk assessment and promotes improved decision-making, is one significant topic addressed. The article's primary objective is to analyse how financial institutions can improve their performance by integrating artificial intelligence into risk management strategies. The sample, which consists of financial institutions listed on the Bucharest Stock Exchange, highlights the difficulties and moral issues surrounding the application of AI in the financial industry, such as data security, interpretability of algorithms, and decision-making accountability. Exploring these aspects provides a comprehensive perspective of how AI is changing and improving risk management in the accounting and financial sectors, emphasizing both the advantages and difficulties of this significant transformation. This case study provides a window into how financial risk analysis is changing in the modern era and shows how embracing AI technology can be a transformative force for risk management.

Keywords: Risk Management; artificial Intelligence; Challenges; Opportunities; Accounting

JEL Classification: M40; M16

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Introduction

The risk management process stands as the cornerstone of a company's success. When a company establishes the foundation of an ethical culture, with the ultimate goal being financial performance, careful consideration must be given to how it will manage risks that could potentially affect the company in the future (Naim, 2022). History has undeniably shown us that no company is immune to the impact of both internal and external risks. What is crucial to note is that the distinguishing factor among companies lies in how they have effectively engaged with the impact of these risks and mitigated their effects. This accomplishment can be attributed to a meticulously structured risk management strategy, one that is applied at every hierarchical level within the organization.

But what happens when technology reaches a point where the human ability to manage these risks is exceeded? Or, perhaps even more concerning, when technology itself could potentially pose a risk? The progress of artificial intelligence (AI) and the increasing capacity for automation across various fields spark numerous controversies and insecurities regarding the possibility of the complete replacement of human resources with artificial counterparts. This aspect represents a risk not only for companies but also for individuals in general, bringing to the surface ethical and social challenges. The fact that advanced technology can assist in making definitive decisions within the context of human life and manipulate sensitive information requires companies to restructure how they approach the risk management process (Taherdoost & Madanchian, 2023).

Furthermore, given the way technology is advancing, it requires not only a legal and theoretical reevaluation of risk management processes but also the development of methods to anticipate potential risks that may arise due to the rapid evolution of technology. However, technology is advancing, whether we like it or not; therefore, it should be used to our advantage, for the benefit of our companies, businesses, and society as a whole. Artificial intelligence is already being employed in specific areas, industries, and activities within the risk management process, given its substantial potential to enhance decision-making processes (Huang & Li, 2017).

This article is focused on examining the opportunities and challenges associated with the integration of artificial intelligence in the risk management procedures of a sample of banks listed on the Romanian Bucharest Stock Exchange (BVB). The primary objective of this study is to assess the implications of incorporating AI into risk management procedures and to determine whether this integration enhances the value of the examined institutions or gives rise to associated risks. This research is based on manually collected data presented in the financial documents for 2019-2022. Currently, the Bucharest Stock Exchange lists BRD - Groupe Societe Generale S.A.; Patria Bank S.A. and Banca Transilvania S.A. among the few institutions that have incorporated artificial intelligence into their risk management processes.

Considering the research methodology, the literature review represents the initial step in understanding the concept of artificial intelligence and whether the advantages of

implementing AI outweigh the potential risks, justifying the second part of this research. After conducting a comprehensive analysis, this study systematically examined the similarities and differences related to the integration of artificial intelligence in the risk management processes of banks listed on the Bucharest Stock Exchange (BVB).

1. Review of the scientific literature

A successful risk management process aligns with the company's goals, ensuring adaptability in the face of uncertainties. By integrating risk management seamlessly into organizational operations, businesses can navigate challenges, capitalize on opportunities, and enhance overall performance and competitiveness. Implementing robust risk management strategies empowers enterprises to conduct a meticulous analysis of their projects, delving deep into the intricate interplay of strengths, weaknesses, opportunities, and threats. Through comprehensive risk assessments, organizations can identify latent potentials, anticipate challenges, and strategically navigate through the intricate landscape of uncertainties (Zigiene et al., 2019). By mitigating vulnerabilities and capitalizing on strengths, businesses cultivate a nuanced understanding of their projects. This fosters resilience, informed decision-making and adaptive strategies, all crucial for ensuring long-term success in the contemporary dynamic and competitive business environment.

The evolution of artificial intelligence (AI) in risk management activities represents a significant paradigm shift in the way businesses perceive and handle uncertainties. Historically, risk management relied heavily on traditional methods and human expertise, but with the advancment of AI technologies, the environment is drastically changing. KPMG (2021) states that AI has enabled organizations to process massive datasets, identify patterns, and predict potential risks with unprecedented accuracy. Moreover, AI-driven simulations and scenario planning have become essential in modelling various risk scenarios, helping organizations prepare for a wide array of potential challenges. This evolution has not only streamlined risk assessment but has also empowered businesses to make proactive, data-driven decisions, enhancing their overall resilience in the face of uncertainties.

In recent years, banks and financial institutions have embraced the power of AI algorithms to revolutionize their operations (Giudici, 2018). These organizations began using AI algorithms to evaluate credit risks, find fraudulent activity, and manage investment portfolios. Traditional methods of identifying fraudulent activities often fell short in the face of the sophisticated schemes employed by fraudsters. AI algorithms, equipped with advanced machine learning techniques, can analyse vast amounts of transaction data in real time. According to Yuan & Fletcher (2018), by identifying subtle patterns and anomalies, these algorithms can swiftly flag potentially fraudulent transactions, enabling financial institutions to take immediate action and prevent financial losses. AI-driven risk management tools have become invaluable assets, aiding businesses in understanding, quantifying, and mitigating risks more effectively than ever before.

Furthermore, AI has proven instrumental in assessing credit risks, a fundamental aspect of financial operations for lending institutions (Xiaohui, 2019). Traditional credit assessment methods often relied on historical data and predetermined criteria, which sometimes lacked the depth and accuracy required for a comprehensive risk evaluation. AI algorithms, on the other hand, can analyse diverse and dynamic datasets, including customer behaviour, spending patterns, and even social media activities. By leveraging this multifaceted data analysis, financial institutions can gain a more nuanced understanding of an applicant's creditworthiness. This not only improves the accuracy of credit risk assessments but also allows for more personalized lending decisions, benefiting both the institution and the borrower.

In addition to fraud detection and credit risk assessment, AI has played an important role in optimizing investment portfolios. Managing investment portfolios involves complex decision-making processes, considering numerous factors such as market trends, asset performance, and risk tolerance. AI algorithms utilize predictive analytics to analyse historical market data and identify trends that are often imperceptible to human analysts. By processing this data, AI generates valuable insights, aiding financial professionals in making informed investment decisions (Schuett, 2023). Moreover, AI-driven algorithms can continuously monitor market fluctuations and adjust investment strategies in real time, ensuring that portfolios are dynamically optimized to capitalize on emerging opportunities and mitigate potential risks. These early applications displayed the huge potential of AI in handling complex risk scenarios (Varzaru, 2022). As technology advanced, other industries, such as healthcare, insurance, and supply chain management, followed suit. However, alongside these opportunities come a set of challenges, ranging from ethical concerns and data security issues to the need for specialized expertise and regulatory compliance. Therefore, Table no. 1 represents an exploratory analysis of the research literature, summarizing the most common challenges and opportunities related to the integration of artificial intelligence in the risk management process.

Table no. 1. Exploring Opportunities and Challenges in AI Integration for Risk Management

Opportunities	Challenges
Risk Assessment	Data Security and Privacy Concerns
Predictive Analytics	Change Aversion
Automation	Implementation Costs
Better Fraud Detection	Ethical Implications
Operational Efficiency	Integration Complexity

Enhanced Decision-making	Regulatory Compliance
Improved Customer Experience	Skill Gap and Workforce Training

Source: own computation based on literature analysis

In the banking sector, the integration of artificial intelligence has led to a significant shift in traditional risk assessment methods. AI-driven automation operates by rapidly analysing extensive datasets that would be challenging to process manually. Automated risk assessment tools within banks excel at identifying potential risks and vulnerabilities in real time scenarios, a capability that holds immense strategic value. By promptly recognizing risks, these tools empower banks to respond proactively, enabling timely and well-informed decision-making. By leveraging the power of AI and machine learning, banks are not only able to assess existing risks but also forecast future challenges and opportunities with a high degree of accuracy. Predictive analytics models use historical data, customer behaviour patterns, market trends, and a multitude of other variables to generate predictions that guide strategic decision-making.

Moreover, the integration of predictive analytics enhances the customer experience, allowing banks to offer tailored solutions based on individual financial needs and preferences. By gaining a deeper understanding of customer behaviour and preferences, banks can provide more targeted and personalized financial advice, ultimately strengthening customer relationships and loyalty. Ethical implications also come into play, particularly with AI applications. Customer data ethics, AI biases, and the possible influence on employment are critical ethical quandaries that must be carefully considered (Zhang et al. 2018).

Setting the pace in the modernization of banking operations, automation is a transformative force, reshaping operational paradigms and customer experiences alike. Through automated processes, banks achieve unparalleled efficiency, reducing the time and effort required for routine tasks such as transaction processing, account management, and regulatory compliance. This streamlined efficiency not only ensures faster service delivery but also minimizes errors, enhancing overall reliability. In an era with high cyber threat risks, advanced AI algorithms serve as vigilant guardians, analysing every transaction in real time. By identifying the subtlest anomalies, these systems prevent fraudulent activities before they can impose financial harm. This proactive position protects customers and upholds the integrity of the entire banking system. The continuous evolution of fraud detection technologies ensures that banks stay one step ahead of sophisticated cyber attacks, fortifying the digital realm where most financial interactions occur. Given the sensitive nature of financial information, the most pressing challenge is data security and privacy. As banks embrace advanced technologies, protecting customer data from cyber threats becomes increasingly important. Addressing these concerns frequently leads to change aversion in the organization. Employees who are accustomed to traditional methods may resist the

adoption of new technologies out of fear of disrupting their routines. This resistance, which reflects the human aspect of technological implementation, can stymie necessary changes (Li & Shroff, 2017).

Integrating cutting-edge technologies necessitates significant investments in infrastructure as well as training. These costs occasionally collide with budgetary constraints, requiring banks to carefully balance innovation and fiscal responsibility. Furthermore, integration complexity complicates matters. Banks frequently rely on legacy systems, making seamless integration with new technologies a difficult task. These complexities are intertwined with regulatory compliance. The banking industry operates within a strict regulatory framework, necessitating adherence to guidelines even as technology evolves. This adherence not only necessitates meticulous planning but also influences the trajectory of technological implementations (Moses et al., 2018).

Another issue that arises is the skill gap and workforce training. As technology advances, banks must ensure that their workforce has the necessary skills to effectively use these tools. To close this gap, comprehensive training programs that foster a workforce capable of navigating the digital landscape are required. These challenges are linked, illustrating the multifaceted nature of the banking sector's technological evolution. Addressing them necessitates not only technological prowess but also a comprehensive approach that balances innovation, ethics, compliance, and employee adaptability. Addressing these challenges is crucial for maximizing the benefits of AI in risk management. It is critical to establish confidence in AI-powered risk management solutions. AI algorithm dependability and security must be trusted by stakeholders. Transparent AI models, together with effective cybersecurity measures, aid in addressing trust and security issues, hence increasing stakeholder confidence in AI applications.

Looking ahead, the advancement of AI in risk management is expected to continue at a rapid rate. Businesses will benefit from more accurate risk forecasts and actionable insights as AI algorithms improve. However, corporations must spend not just on cutting-edge technologies, but also on ethical norms, regulatory compliance, and the ongoing growth of human knowledge.

2. Research methodology

Following the research methodology, this article is structured into two segments. The initial section involves a rigorous examination of available data, laying the groundwork for the subsequent part of this paper. The research study employed a manual data collection method, drawing from multiple sources such as publicly accessible financial statements, statements provided by third parties, and press releases issued by the selected banks. This methodical approach to gathering data, provided the accuracy and reliability of the examined information.

Considering the scope of this research, we found it suitable to select a sample of three banks, BRD Groupe Société Générale, Patria Bank S.A and Banca Transilvania; that are publicly listed and active on the Romanian financial market. The analysed period

extends from 2019 to 2022. For these banks, we have identified four key indicators that determine the impact of AI integration in the risk management process. These indicators were meticulously analysed using a quantitative approach. Mean (average) and standard deviation calculations were employed, providing valuable statistical insights. These calculations have significant implications for our study, allowing us to discern patterns, trends, and variations in the data. We analysed these indicators comparatively across banks over four years, observing whether the integration of artificial intelligence has improved financial outcomes or not. We examined the information provided by the companies and devised a method to assess each indicator. The scale ranges from 1 to 5, where 1 represents a significant negative impact, 3 indicates a moderate impact, and 5 signifies a substantial positive impact. This scale allows us to assess the effectiveness of AI integration in risk management practices across the examined banks.

The application of the quantitative research method resulted in a detailed and objective evaluation, revealing the complexity of each bank's performance. These findings provide a scientific foundation for strategic decision-making in the dynamic financial sector, especially with the integration of AI in risk management. In addition, they brought insight into the relative strengths and weaknesses of the banking institutions. Using quantitative analytical methods, we have gained important insights into the efficiency of AI integration in the banking sector. Stakeholders need this empirical understanding since it gives them the data-driven insights they need to make wise decisions about incorporating AI technologies into strategies for risk management. This study holds significant importance within the realm of AI integration in risk management within the banking sector. By examining real-world applications and challenges faced by BRD Groupe Societe Generale S.A., Banca Transilvania, and Patria Bank S.A., this research contributes valuable insights to the existing literature. Furthermore, it is noteworthy that similar studies related to the integration of AI have been carried out in various industries such as public administration, healthcare, and manufacturing, demonstrating the adaptable application of AI technologies in multiple domains (Wirtz et al. 2020). The findings of this study not only enhance our understanding of AI's impact on risk management practices but also bridge the gap between different sectors, fostering interdisciplinary collaborations and knowledge exchange. In addition, the cross-sectorial viewpoint draws attention to shared difficulties and advantages, opening the door for cooperative efforts to fully utilize AI. It is important to note, however, that this study has its limitations, including the scope of the selected sample and the specific context of the Romanian financial market. Given that the research was conducted specifically on the banking sector and the analysis was done over four years within three banking institutions, the sample size is limited. Despite careful selection, the sample size only represents a portion of the total population, which may affect the extent to which the findings can be applied. The study's emphasis on the Romanian financial market also raises the possibility that results were impacted by regionally specific cultural, legal, and economic variables. To improve the overall comprehensiveness and applicability of the study's findings, future research projects could incorporate a more diverse and representative sample and investigate different financial markets in order to address these limitations.

3. Results and discussions

Considering the restricted sample size and the specific banking sector context in which these financial institutions operate, it is imperative to emphasize a detailed presentation and a comprehensive analysis of these banks. This includes a focus on essential indicators that might be significantly influenced by the integration of artificial intelligence (AI) in risk management processes. The in-depth analysis and critical indicators are outlined in Table no. 2 for reference.

Table no.2 Financial Performance Comparison of Banks (2019-2022)

Bank	Indicator	2019	2020	2021	2022
BRD Groupe Societe Generale S.A.	Return on Assets (ROA)	2.60%	1.60%	2%	1.90%
	Return on Equity (ROE)	20.10%	11%	13.50%	16%
	Capital Adequacy Ratio (CAR)	22%	25.10%	23.30%	21.50%
	Total Assets	55,853	61,635	67,015	71,523
Patria Bank S.A.	Return on Assets (ROA)	0.17%	0.10%	0.26%	0.51%
	Return on Equity (ROE)	1.60%	0.90%	2.78%	5.94%
	Capital Adequacy Ratio (CAR)	17.75%	21.60%	19.31%	20.08%
	Total Assets	3,194	3,430	3,826	4,157
Banca Transilvania S.A.	Return on Assets (ROA)	2,03%	0,98%	1.60%	1.68%
	Return on Equity (ROE)	20,26%	8,86 %	18,04 %	25,25 %
	Capital Adequacy Ratio (CAR)	N/A	N/A	N/A	N/A
	Total Assets	87.438	103.355	125.062	133.96

Source: own computation based on financial documents released by the companies from 2019 to 2022. (Total assets are expressed in million RON)

According to the table, we notice that BRD Groupe Societe Generale S.A. exhibits moderate to robust performance across the measured parameters. The fluctuating but generally positive return on assets (ROA) suggests reasonable profitability concerning total assets, portraying the highest ROA over the years. Although return on equity (ROE) varies, the bank maintains acceptable returns for shareholders. Moreover, the consistently high capital adequacy ratio (CAR) signifies strong stability and a resilient financial position. For BRD Groupe Societe Generale S.A., integrating AI in risk management processes could further enhance their already stable foundation.

In the context of Patria Bank S.A., it is evident that this consistently portrays lower performance metrics compared to its counterparts. The consistently low ROA and ROE indicate limited profitability and shareholder returns. However, the bank maintains an acceptable CAR, indicating a stable capital base. Incorporating AI has the potential to

be a game-changer for Patria Bank, enabling more precise risk assessments, personalized customer offerings, and efficient fraud detection. AI-driven predictive analytics could aid in identifying profitable opportunities within the market, potentially improving both ROA and ROE over time.

On the other hand, Banca Transilvania displays a mix of strong financial metrics and consistent growth. The bank's ROA fluctuates moderately, suggesting efficient utilization of assets to generate profits. ROE, despite variations, remains relatively high, indicating solid returns for shareholders. Unfortunately, the absence of available CAR data makes it challenging to determine the bank's capital adequacy precisely. However, given its substantial growth in total assets, it is evident that Banca Transilvania is expanding. Integrating AI into their risk management processes could further optimize asset utilization, improve credit risk assessments, and enhance fraud detection mechanisms. In the pursuit of a deeper understanding of the relationship between financial performance, risk management, and artificial intelligence (AI) adaptability, Table no. 3 highlights four key performance indicators crucial for managing risk and AI technology.

Table no.3 Key Performance Indicators

Indicator	
Accuracy of Risk Prediction	Adaptability to Market Changes
Operational Efficiency	Compliance and Regulatory Adherence

Source: own computation based on manually collected data

In the research process, we identified four crucial indicators regarding the impact of AI integration on risk management procedures. The accuracy of risk prediction stands as a fundamental metric that quantifies the precision with which financial institutions can anticipate and mitigate potential risks. This indicator explores the fundamentals of risk management and provides insight into these institutions' ability to predict the future in a rapidly changing financial environment. This metric, which is closely related to AI developments, shows how AI technology enhances financial institutions' predictive capacities and allows them to proactively identify and mitigate risks with previously unheard-of accuracy.

The second critical metric, adaptability to market changes, measures how flexible and sensitive these institutions are to the constantly shifting dynamics of the market. In a time when market trends are changing at a never-before-seen rate, the capacity to quickly adjust operations and strategies is critical. This measure emphasizes how crucial it is to anticipate changes in the market and swiftly modify operational frameworks to take advantage of new opportunities. In this situation, artificial intelligence (AI) plays a revolutionary role by giving organizations access to real time data analysis and market

insights, enabling them to make quick, data-driven decisions that keep their strategies in line with consumer demands. Operational efficiency explores the inner workings of financial institutions. It carefully evaluates how well different organizational processes operate in terms of resource allocation, transaction processing, and overall operational efficacy. Operational efficiency is a sign of an organization's capacity to maximize its resources, increase output, and guarantee flawless customer service. Here, artificial intelligence (AI) integration improves operational effectiveness and customer satisfaction by automating repetitive tasks, streamlining workflows, and enhancing decision-making processes.

Adherence to strict compliance standards is mandatory in the highly regulated financial landscape of today. This indicator carefully assesses how closely these establishments adhere to legal requirements, ethical standards, and transparency. Compliance is a core commitment to moral behavior and preserving stakeholders' trust, not just a way to check boxes on regulations. By improving data accuracy, automating compliance checks, and enabling real time monitoring, AI solutions in compliance management help financial institutions meet regulatory requirements while concentrating on their main goals.

We have established a strong framework for the quantitative assessment of the four indicators influencing the incorporation of AI in risk management processes by utilizing the 1–5 scale. In Table no. 4 each numerical value represents a specific level of performance and offers a complex view of the institutions' capacities. This standardized approach enables a comprehensive analysis, facilitating clear comparisons and the precise identification of strengths and areas for improvement. By assigning numerical values to qualitative aspects, this scale transforms abstract concepts into tangible metrics, fostering a deeper understanding of the impact of AI integration on risk management practices.

Table no.4 AI and Risk Management Evaluation

Bank	Indicator	2019	2020	2021	2022
BRD Groupe Societe Generale S.A.	Accuracy of Risk Prediction	5	5	5	3.5
	Operational Efficiency	5	4	5	5
	Compliance and Regulatory Adherence	3	3	4	3
	Adaptability to Market Changes	4	4	4	4
Patria Bank S.A.	Accuracy of Risk Prediction	4	5	5	5
	Operational Efficiency	4.5	5	3.5	3
	Compliance and Regulatory Adherence	3	4	5	5
	Adaptability to Market Changes	4	4	4	4
Banca Transilvania S.A.	Accuracy of Risk Prediction	5	5	5	5
	Operational Efficiency	3	3	3	3
	Compliance and Regulatory Adherence	5	5	5	5
	Adaptability to Market Changes	4	4	4	5

Source: own computation

Patria Bank and Banca Transilvania consistently show a high degree of accuracy in predicting risks, maintaining strong and stable scores over the years, according to the Consistent Accuracy in Risk Prediction indicator. This suggests that they have strong risk assessment techniques and a reliable track record of making choices based on precise risk assessments. Even though BRD Groupe Societe Generale's risk prediction methods are generally accurate, they show a slight decline in 2022, indicating the need for additional assessment and possibly even improvement. Predictive analytics is made possible by integrating AI algorithms, which analyse enormous datasets. AI is capable of recognizing intricate patterns and making precise risk assessments. Machine learning models are advantageous to banks since their models constantly acquire knowledge from new data, which guarantees current risk assessments. Throughout every year, BRD Groupe Societe Generale has demonstrated outstanding operational efficiency, which is suggestive of successful internal procedures and management of resources. Although Patria Bank and Banca Transilvania are profitable, they might perform more effectively. Banca Transilvania demonstrated its ability to improve operational efficiency in 2020 by making noteworthy advancements. Both banks have the opportunity to improve internal processes despite the fact that they are currently operating successfully, which could result in lower costs and better overall performance. The ongoing improvement in BRD Groupe Societe Generale's efficiency illustrates its commitment to operational excellence and its ability to make efficient use of resources to meet its goals. In reference to the third indicator, it is evident that Banca Transilvania and Patria Bank excel in terms of regulatory adherence and compliance, continuously achieving high ratings in this domain. This demonstrates their dedication to abiding by industry rules and moral principles, building confidence among stakeholders. BRD Groupe Societe Generale should look into ways to improve its adherence tactics while still keeping a respectable level of compliance. In the banking industry, compliance is critical, and ongoing efforts to conform to regulatory requirements are necessary to reduce risks and uphold a positive reputation. It is clear from their remarkable flexibility in response to market shifts that all three banks are capable of navigating these changing conditions. Their ability to adjust highlights their strategic agility and resilience, enabling them to effectively respond to changes in market dynamics, consumer preferences, and industry trends. Patria Bank and Banca Transilvania consistently exhibit flexibility, which is indicative of their proactive stance in keeping up with industry advancements. Large volumes of data from multiple sources can be processed by AI-based market analysis tools, which can then deliver insights in real time. Banks are able to modify their offerings in response to competitive strategies, market trends, and customer preferences that are recognized by machine learning algorithms.

Tools for market analysis with AI capabilities can track consumer behavior, examine social media sentiment, and keep an eye on rival activity. Since machine learning algorithms can predict market trends, banks can make timely adjustments to their services and offerings. Overall, even though each bank excels in particular areas, adopting best practices and exchanging knowledge among the banks could be part of a comprehensive improvement strategy. Working together to solve their problems could result in significant improvements, setting each bank up for future success in the competitive banking industry.

Artificial intelligence (AI) integration has become a transformative force in the constantly shifting environment, where complexities are as common as opportunities. It has completely changed the way banking institutions manage risks. The complexity of financial markets makes it necessary to have an advanced awareness of risk dynamics. To gain a deeper understanding of the challenges of risk management in the banking industry, this study carried out a thorough examination of the averages and standard deviations for each indicator presented in Table no. 5.

Table no.5 Calculated Averages and Standard Deviations

Bank	**BRD Groupe Societe Generale S.A.**		**Patria Bank S.A.**		**Banca Transilvania S.A.**	
Indicator	**Average (Mean)**	**Standard Deviation**	**Average (Mean)**	**Standard Deviation**	**Average (Mean)**	**Standard Deviation**
Accuracy of Risk Prediction	4.625	0.650	5	0	4.750	0.433
Operational Efficiency	4.750	0.433	3	0	3.95	0.730
Compliance and Regulatory Adherence	3.25	0.43	5	0	4.5	0.866
Adaptability to Market Changes	4	0	4.25	0.43	4	0

Source: own computation

Considering the results in Table No. 5, we observe that BRD Groupe Societe Generale S.A. shows good performance in risk prediction, with an average of 4.625 and a standard deviation of 0.650. The consistent results in the context of AI integration suggest that their models can systematically anticipate risks over time, providing a robust foundation for risk management strategies. Furthermore, it demonstrates high operational efficiency, reflected in its low standard deviation of 0.433 and an average score of 4.750. This consistency implies that their operational processes are significantly enhanced. Through the utilization of technologies like machine learning algorithms and robotic process automation (RPA), the bank can maximize overall efficiency, reduce errors, and optimize routine tasks. These improvements can lead to substantial cost savings and, more importantly, elevate the quality of customer service. On the other hand, we observe that the bank falls behind in terms of compliance and regulatory adherence, with an average of 3.25 and a standard deviation of 0.43. This indicates some variation in meeting regulatory requirements. Integrating AI into their compliance framework could prove instrumental. Automating compliance checks through AI algorithms ensures adherence to regulations and lowers the risk of noncompliance fines, thereby making their operations more robust and secure.

On a positive note, the bank demonstrates a strong ability to adapt to market changes, as evidenced by an average score of 4 and a standard deviation of 0. This indicates a promising future where their regulatory requirements regarding AI integration in risk management procedures are likely to improve. Aligning their strategies with market dynamics and incorporating advanced AI techniques, such as predictive analytics, will

enable proactive decision-making in response to market shifts, ensuring and enhancing their competitive advantage. In addition, encouraging a culture of innovation and ongoing learning among their employees can help to ensure that AI solutions are seamlessly integrated across multiple departments. The bank can sustain its current high standards and create the foundation for future growth and sustainability in a constantly evolving financial landscape by remaining at the forefront of artificial intelligence advancements and regulatory compliance.

Patria Bank S.A. reveals an extremely stable and accurate risk prediction system with an impressive average score of five and no deviation, demonstrating a highly reliable risk prediction model. To further enhance their risk management strategies, Patria Bank can concentrate on implementing advanced AI algorithms, such as deep learning, to refine their already high-precision risk assessments. Exploring more complex models, like deep learning, can potentially lead to even more accurate predictions, ensuring a proactive approach to risk mitigation. Patria Bank S.A. faces challenges in operational efficiency, reflected in an average score of 3 with no deviation. Integrating AI in this domain can play a pivotal role in optimizing their operations. AI-driven process automation can significantly minimize human intervention, leading to faster and error-free operations. This not only reduces operational costs but also accelerates processes, ultimately enhancing their efficiency and elevating customer satisfaction. By investing in AI-powered operational solutions, Patria Bank can streamline its workflows and deliver seamless services to its clients.

Moreover, Patria Bank S.A. excels in compliance with an outstanding average score of five and no deviation, indicating a stable and reliable compliance system. To further strengthen their compliance efforts, implementing AI-powered systems for in-depth audits can be valuable. These systems can conduct thorough analyses, minimizing the risk of regulatory fines and reputational damage. By leveraging AI in compliance, the bank can enhance its credibility and maintain a strong foothold in the industry. Compared to BRD Groupe Societe Generale S.A., Patria Bank S.A. demonstrates a moderate level of adaptability to market changes, as reflected by an average score of 4.25 and a standard deviation of 0.43. Enhancing their adaptability is imperative given the ever-changing dynamics of the financial landscape. This underscores the need for Patria Bank S.A. to further invest in strategies and technologies that ensure swift responses to market fluctuations and evolving customer demands.

In the realm of risk prediction, Banca Transilvania S.A. highlights a robust performance, featuring an impressive average score of 4.75 with a minimal deviation of 0.433. This remarkable stability underscores the bank's advanced risk modelling techniques, which have likely been supported by advanced AI algorithms. To further strengthen their risk prediction capabilities, Banca Transilvania can consider exploring combined learning methods, harnessing the power of multiple algorithms to enhance the accuracy and reliability of their risk assessments. When it comes to operational efficiency, Banca Transilvania S.A. exhibits average performance, maintaining a mean score of 3.95 and a standard deviation of 0.730. To optimize their operational processes,

the bank can explore the implementation of AI-driven solutions such as robotic process automation (RPA) and intelligent workflow management.

In terms of compliance, Banca Transilvania S.A. stands out with an impressive average score of 4.5 and a standard deviation of 0.866, reflecting a strong commitment to regulatory adherence. While the bank already excels in this area, it can further enhance its compliance mechanisms by integrating AI-powered regulatory intelligence platforms. These platforms leverage natural language processing and machine learning algorithms to keep abreast of evolving regulations, ensuring real time compliance checks and minimizing the risk of non-compliance penalties. Additionally, Banca Transilvania S.A. maintains a stable adaptability to market changes, evident from its average score of four and no deviation. By staying ahead of market shifts, Banca Transilvania can capitalize on emerging opportunities and fortify its competitive position.

In this research, quantitative methods were employed to assess the performance of three prominent banks: BRD Groupe Societe Generale S.A., Patria Bank S.A., and Banca Transilvania S.A. Various statistical measures were utilized to analyse the collected data, as presented in table no. 5. The study focused on key indicators such as the accuracy of risk prediction, operational efficiency, compliance and regulatory adherence, and adaptability to market changes. The analysis revealed valuable insights into the banking sector's overall performance in these specific areas. BRD Groupe Societe Generale S.A. demonstrated a high level of accuracy in risk prediction, with an average score of 4.625 and a relatively low standard deviation of 0.650. Patria Bank S.A. excelled in compliance and regulatory adherence, achieving a mean score of 5 with a standard deviation of 0. Additionally, Banca Transilvania S.A. showcased commendable operational efficiency, averaging 4.75 with a standard deviation of 0.433. The research findings not only shed light on the strengths and weaknesses of each bank but also provide a basis for strategic decision-making within the banking sector. The utilization of quantitative research methods allowed for a rigorous and objective assessment, enabling a comprehensive understanding of the banks' performance metrics and facilitating informed actions for future improvements.

The study's conclusions highlight how incorporating AI into risk management across the banking industry has the potential to be revolutionary. Banca Transilvania S.A., Patria Bank S.A., and BRD Groupe Societe Generale S.A. have all shown variable degrees of success in using AI technologies to improve their risk management procedures. Realizing that AI can greatly improve accuracy, operational efficiency, compliance, and flexibility to market changes is the common thread among these banks. These technologies open the door to a more competitive, resilient, and fundamentally customer-focused banking environment.

The research highlights the vital significance of customization in the application of AI solutions in banking establishments. Customized approaches are necessary to ensure optimal performance and seamless integration due to the distinct needs and challenges of each bank. BRD Groupe Societe Generale S.A. may choose to concentrate on streamlining its compliance procedures and using AI to automate regulatory audits and

reduce discrepancies. Patria Bank S.A. has demonstrated remarkable accuracy in risk prediction. To sustain this level of accuracy, the bank may investigate enhanced AI algorithms or even new technologies such as quantum computing for risk assessments that are unmatched. Despite its overall stability, Banca Transilvania S.A. might want to think about implementing AI-powered regulatory platforms and predictive analytics to strengthen its compliance mechanisms and react proactively to market changes.

Conclusions

A revolutionary paradigm shift has occurred with the incorporation of artificial intelligence (AI) into banking institutions' risk management procedures. This study is evidence of the critical role artificial intelligence has played in changing the risk management environment. Adopting AI is not a choice but a necessity at a time when financial markets are becoming more complex and intertwined. Armed with AI-driven risk management systems, banks can optimize their operations and uphold strict regulatory compliance in addition to being better able to negotiate the complexities of the financial world.

Artificial intelligence (AI) has an impact that goes beyond simple quantitative measurements; it enters the innovation and flexibility culture of financial institutions. The integration of natural language processing, machine learning, and predictive analytics enables banks to transform their approaches to risk management. AI gives banks the capacity to proactively anticipate future challenges in addition to improving the efficiency and accuracy of risk assessments. Their continued growth and resilience in a constantly changing financial landscape are ensured by this foresight. Essentially, incorporating AI into risk management procedures is a strategic requirement rather than just an improvement. By embracing and investing in AI technologies, banks are changing the very nature of banking in the future, not just protecting their operations from unpredictability. When artificial intelligence (AI) is smoothly incorporated into risk management procedures, the banking industry can move closer to being more safe, effective, and creative.

The study also emphasizes how important it is for financial institutions to develop a culture of ongoing learning and adaptation. Integration of AI solutions is just the start when it comes to staying ahead in the constantly changing financial landscape. It is critical to establish a work environment where staff members have the abilities and knowledge needed to use these technologies efficiently. The banking industry can confidently embrace AI-driven advancements thanks to investments in training programs, partnerships with AI experts, and innovation encouragement. AI has the potential to revolutionize many industries, not just banking; research in the retail and construction sectors has shown comparable advancements. Artificial intelligence (AI) algorithms in the construction industry optimize resource allocation, project timelines, and cost management, resulting in more sustainable and productive building practices (Abioye et al. 2021). Similarly, AI-driven data analytics improve customer experiences, customize marketing campaigns, and speed up supply chain management in the retail sector (Popa et al. 2021). These cross-industry applications emphasize the way AI

technologies impact all industries, changing core paradigms and extending beyond particular industries.

The contribution of this paper relies on the complex perspectives on the customized applications of AI in risk prediction, operational efficiency, compliance, and market adaptability by carefully examining the performance indicators of BRD Groupe Societe Generale S.A., Patria Bank S.A., and Banca Transilvania S.A. This customized analysis offers an approach for the successful integration of AI technologies based on unique organizational needs and challenges, serving as a model for other researchers and financial institutions.

However, it is important to acknowledge the limitations of this study. The analysis's focus on a particular group of banks in a given area is one of its limitations. If the results are to be applied to a wider global context, additional studies involving a wider variety of financial institutions may be necessary. Additionally, the study's reliance on historical data up to 2022 might not capture the most recent advancements in AI technology. Quick advancements in AI might bring in additional factors and considerations that this study did not take into account. Furthermore, while the paper provides strategic recommendations, the implementation challenges and costs associated with integrating advanced AI systems are not thoroughly explored. Future research could look deeper into these practical aspects, offering a more comprehensive understanding of the challenges faced during the AI integration process.

Despite these limitations, the research provides a crucial foundation for future investigation and improvement of AI integration in the banking industry. This research contributes to the current discourse and lays the groundwork for future investigations by recognizing its limitations and strengths, which will continue to advance the dynamic intersection of artificial intelligence and finance.

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