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# A COMPARATIVE EXPLORATORY STUDY OF AI AND BIG DATA ADOPTION IN FINANCIAL DECISION-MAKING

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**Abstract**
*This exploratory qualitative study investigates the adoption and perceived impact of Artificial Intelligence (AI) and Big Data technologies on financial decision-making processes within organizations. Through a comparative case study analysis of five major Romanian companies (Banca Transilvania, Electrica SA, Romgaz, eMAG, Dedeman) and a contextual benchmark with international counterparts (JPMorgan, Enel, ExxonMobil, Amazon, Home Depot), the research identifies key drivers, implementation strategies, and organizational challenges associated with digital transformation in finance. The analysis relies on triangulated data from publicly available corporate documents, annual reports, strategic plans, and press releases. Findings reveal a spectrum of digital maturity levels, with advanced adopters leveraging AI for personalized services and operational efficiency, while slower adopters face structural and cultural barriers. The study concludes that successful integration depends not only on technological investment but also on organizational readiness, strategic vision, and ethical governance. This research provides a foundational framework for understanding digital transformation trajectories in emerging versus developed financial contexts.*

**Keywords:** *artificial intelligence; big data; decision-making process; digital transformation*

**JEL classification:** *D53, G1, G11*

## INTRODUCTION

Artificial intelligence systems are increasingly recognized for their fundamental capacity to facilitate better decision-making within complex organizational frameworks (Rajagopal et al., 2022). This technological evolution is intrinsically linked to the rise of Big Data, which transforms the modern economy by improving investor forecasts and reducing equity uncertainty (Begenau et al., 2018). The growing complexity and volume of financial data, driven by globalization and advancements in digital technologies, have significantly transformed decision-making processes in financial markets (Pillai, 2023). These advancements are central to the broader FinTech revolution, which encompasses digital innovations and technology-enabled business models that reshape market outcomes and foster financial inclusion (Philippon, 2019; Goldstein et al., 2019). By leveraging AI and Big Data, financial institutions can process and analyze data in real-time, thereby fortifying the efficiency of operations and promoting more informed decision-making (Ionescu & Diaconita, 2023). However, many firms remain at an early stage of using machine learning, focusing on simple predictive models due to perceived challenges regarding the explainability and interpretability of complex algorithms (European Banking Authority, 2020). Consequently, the strategic integration of these technologies supports inclusive growth and provides the essential financial services required for the digital economy to flourish (World Bank, 2023).

## I. LITERATURE REVIEW ON BIG DATA AND ARTIFICIAL INTELLIGENCE IN FINANCIAL DECISION-MAKING

Big Data represents a complex set of large volumes of data, generated from diverse and varied sources, characterized by the well-known "3Vs": volume, velocity, and variety. In the financial field, data can come from banking transactions, accounting reports, market data, social networks, or internal systems, thus creating a high degree of complexity for their management and interpretation. By applying modern analysis and storage techniques, this data can be transformed into strategic information assets that decisively influence decision-making (Cigu et al., 2020). The convergence of Big Data and AI offers unprecedented potential for optimizing financial decisions. Studies show that integrating these technologies increases the accuracy of financial forecasts and improves the ability to identify fraud and emerging risks. At the same time, there is a growing need for clear ethical and regulatory frameworks for the responsible use of data and algorithms in decision-making processes (Buzdugan, 2020; Boghean & Boghean, 2017).



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In order to provide a comprehensive overview of relevant research on the application of Big Data and Artificial Intelligence in financial decision-making, we have summarized the main studies published in the literature *(*see *Table 1).*

**Table 1.** Summary of the main studies on the application of Big Data and Artificial Intelligence in financial decision-making

| Author(s), year | Principal theme investigated | Research methodology | Main conclusions and observations |
|---|---|---|---|
| Begenau et al. (2018) | Big Data's role in finance | Quantitative empirical analysis | Big Data analytics improve forecast accuracy, reduce uncertainty, and lower firms' cost of capital, contributing to the growth of large data-intensive firms |
| Buchak et al. (2018) | Rise of FinTech in mortgage markets | Quantitative study on mortgage origination data | Technological innovation and regulatory arbitrage have driven the rapid expansion of FinTech lenders, significantly increasing their market share in residential mortgage origination |
| Fuster et al. (2019) | Impact of FinTech on mortgage lending | Empirical analysis with loan-level data | FinTech lenders provide faster and more scalable credit origination processes, reducing sensitivity to capacity constraints relative to traditional lenders |
| Goldstein et al. (2019) | Evolution of FinTech in the financial sector | Conceptual and theoretical analysis combined with review of empirical evidence | FinTech represents a structural transformation of finance through technology, altering traditional intermediation, competition, and regulatory frameworks |
| Philippon (2019) | Definition of FinTech | Conceptual analysis and policy-oriented insights | FinTech encompasses both digital innovations and technology-enabled business model innovations, with the potential to enhance competition, efficiency, and financial inclusion |
| Vives (2019) | Digital disruption in banking | Analytical review of technological trends in banking | The rapid adoption of digital technologies and innovative business models is reshaping banking services, accelerating user acquisition and intensifying competitive pressures |
| Berg et al. (2020) | Digital footprints in credit scoring | Empirical analysis of alternative data sources and predictive modeling | Digital footprints offer valuable behavioral information that enhances credit risk assessment, even in the absence of traditional financial data |
| Buzdugan (2020) | Cyber risk management | Systematic literature review | Effective cyber risk management requires dedicated decision support systems, highlighting cybersecurity as a key challenge in digital financial environments |
| European Banking Authority - EBA (2021) | Machine learning in financial institutions | Regulatory assessment and supervisory review | Financial institutions are in early stages of ML adoption, primarily using simple predictive models, while concerns regarding explainability and interpretability limit the use of complex models |
| Agrawal et al. (2022) | Economic impact of AI in finance | Conceptual framework with case examples | AI fundamentally reduces the cost of prediction, leading to widespread adoption across sectors and reshaping decision-making processes, including financial decisions |
| World Bank (2023) | Fintech's impact on financial development | Survey-based empirical analysis | Fintech-driven digital transformation improves market efficiency, supports inclusive growth, and enables the development of financial services essential for the digital economy |
| McKinsey & Company (2023) | Role of generative AI in productivity | Applied industry analysis with case examples | Organizations that are high performers in AI adoption are significantly more likely to integrate AI into product and service development, gaining competitive advantages |
| Pillai (2023) | Integration of AI-driven techniques in Big Data analytics for financial markets | Conceptual and applied analysis with illustrative financial market examples | The growing volume and complexity of financial data necessitates AI-based analytics to improve decision-making accuracy and responsiveness in financial markets |
| Ionescu & Diaconita (2023) | AI, cloud computing, and data management in finance | Conceptual research with technological focus | AI and Big Data technologies enable real-time data processing, enhance operational efficiency, support informed financial decisions, reduce risks, and improve customer experience |


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|---|---|---|---|
| Deloitte Center (2025) | The role of generative AI in productivity, innovation, and client-oriented strategies | Applied industry analysis supported by case examples | Companies increasingly leverage AI, particularly generative AI, to differentiate themselves, enhance productivity, and transform work processes and client engagement |

Source: author's compilation based on specialised literature

The aggregate analysis of the 15 studies highlights a clear convergence between FinTech innovations, AI applications and the use of Big Data as central pillars of financial decision transformation. Studies investigated in the field of Big Data and Artificial Intelligence highlight the convergence of these technologies as key factors in the transformation of financial decisions, improving forecasting accuracy and process efficiency. FinTech, by offering fast and scalable solutions, alters traditional loan models and increases competitiveness in the sector. However, organizations are facing challenges related to cyber risk management and the explicability of AI models. In this context, it is essential to establish ethical and regulatory frameworks to maximise technological benefits and promote financial inclusion.

## II. RESEARCH METHODOLOGY

This study adopts an exploratory qualitative approach to gain a deeper understanding of how companies use AI and Big Data technologies in financial decision-making processes. The research is based on a comparative investigation of a case study applied to five major companies in Romania (Banca Transilvania, Electrica SA, Romgaz, eMAG and Dedeman) in parallel with a contextual analysis of similar international organizations (JPMorgan, Enel, ExxonMobil, Amazon and Home Depot). Through this comparison, the aim is to identify the determinants of technological adoption, digital solution implementation strategies and internal challenges that influence digital transformation in the financial sector.

The analysis is built on a triangulation of secondary data sources, including public corporate documents, annual reports, strategic plans and press releases issued by the analyzed companies. This method allows for a holistic perspective on the practices and outcomes of adopting AI and Big Data technologies, providing a solid understanding of the nuances and differences between organizations in emerging economies and those in developed markets.

*Conceptual Framework*

To guide the comparative analysis of AI and Big Data adoption in financial decision-making, this study employs a multi-level conceptual framework that integrates factors at the technological, organizational, and environmental levels. To guide the comparative analysis of AI and Big Data adoption in financial decision-making, this study employs a multi-dimensional conceptual framework adapted from the Technology-Organization-Environment (TOE) model (Tornatzky & Fleischer, 1990) and integrated with elements from Institutional Theory (DiMaggio & Powell, 1983).The framework posits that the adoption and integration of AI and Big Data technologies are influenced by:

- *Technology context*: Examines the characteristics of AI and Big Data technologies, including data volume, variety, velocity (the 3Vs), system complexity, interoperability requirements, and technological infrastructure maturity.
- *Organization context*: Analyzes internal organizational factors including digital culture, leadership commitment, financial resources, employee skills and training, strategic alignment between technology investments and business objectives, and change management capabilities.
- *Environmental context*: Considers external pressures and enablers such as regulatory frameworks (GDPR, AI Act), competitive dynamics, stakeholder expectations (investors, customers), institutional isomorphic pressures (mimetic, coercive, normative), and macroeconomic conditions.
- *Adoption process*: Traces the implementation journey through Rogers' (2003) innovation diffusion stages, examining how organizations progress from awareness to full integration of technologies in financial decision-making process.

## III. DETERMINANTS OF FINANCIAL DECISION-MAKING IN THE DIGITAL CONTEXT: TECHNOLOGY, ORGANIZATIONAL CULTURE AND ETHICS

The transformation of financial decision-making is driven by three interdependent determinants, each supported by a body of established research and empirical evidence:

*1. The Core Technological Enabler: AI as a "Prediction Machine*. The foundational shift is powered by Artificial Intelligence's ability to drastically reduce the cost and increase the speed of prediction, a core economic


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activity in finance (Agrawal, Gans, & Goldfarb, 2022). The value of these predictions is unlocked by Big Data analytics, which have been shown to improve forecast accuracy, reduce uncertainty, and contribute to the growth of firms (Begenau, Farboodi, & Veldkamp, 2018). This synergy enables the transition from descriptive to predictive and prescriptive analytics, a necessity in an era of exponentially growing data volume (IDC, 2021). Practical applications range from algorithmic trading to AI-driven customer service agents, as implemented by institutions like Banca Transilvania (Druid AI Case Study, 2025).

*2. The Critical Human & Organizational Catalyst*. Technological potential is only realized through organizational readiness. Successful adoption requires a strategic vision that prioritizes digital transformation and a leadership commitment to cultivate a data-driven culture (Porter & Heppelmann, 2014). The World Bank (2023) emphasizes that technological innovation must be accompanied by adaptations in business processes and organizational structures to be effective. Conversely, a primary barrier for moderate adopters is organizational inertia and resistance to change, which can stifle innovation even when technology is available, highlighting the critical role of human and cultural factors.

3. *The Essential Guardrail: Ethics, Governance, and Financial Inclusion*. The power of data-driven decision-making necessitates robust governance. Ethical frameworks must address algorithmic bias, transparency ("explainable AI"), and accountability, concerns that currently limit the adoption of more complex models in regulated finance (European Banking Authority, 2021). Concurrently, these technologies offer a profound opportunity to promote financial inclusion by leveraging alternative data for credit assessment, reaching previously underserved populations (Berg et al., 2020; World Bank, 2023). Thus, a strong ethical and regulatory framework is not a barrier but a prerequisite for sustainable, equitable, and trusted innovation in digital finance.

The profound transformation of financial decision-making in the digital age is not an isolated phenomenon, but rather the result of the convergence of several structural and technological factors that have redefined the global economic context. Essentially, financial decisions have become faster, more accurate, and better anchored in the dynamic reality of the market, precisely because of these factors. Understanding the causes of this change is fundamental to assessing the effectiveness and sustainability of new decision-making models (Porter & Heppelmann, 2014). These interdependent factors are summarized in *Figure 1*.

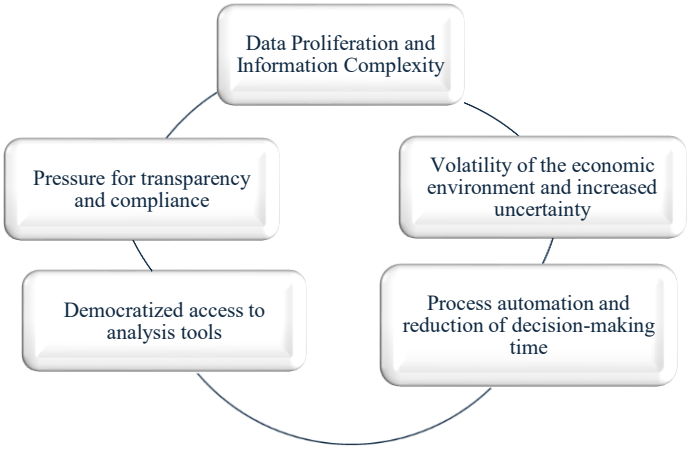


**Figure 1.** Factors influencing financial decision-making in the digital context
Source: Author's own processing based on World Economic Forum, 2015

One of the most important motivations for changing the financial decision-making process is the exponential growth in the volume of data generated globally. According to an IDC report, the amount of digital data doubles every two years, which necessitates sophisticated tools for efficient processing and interpretation. In the financial environment, this abundance of information requires a shift from retrospective analysis to predictive and prescriptive approaches capable of identifying opportunities and risks before they materialize (IDC, 2021).

## IV. THE IMPACT OF AI AND BIG DATA ON FINANCIAL DECISIONS

Digital transformation in the Romanian corporate environment has occurred at an uneven pace, depending on the field of activity, managerial vision, and investment capacity of each organization. This section provides a comparative analysis of five companies operating in different economic sectors, selected based on their relevance to the research topic, the public visibility of their digital strategies, and the degree of access to verifiable information on their performance. The companies analyzed in Romania in the research are: Banca Transilvania (banking sector), Electrica SA (energy sector), Romgaz (natural gas sector), eMAG (online retail), and Dedeman


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(retail). The choice of these companies allows for a complex understanding of how AI and Big Data influence financial decision-making in organizations with distinct profiles and degrees of digital maturity (see *Table 2*).

**Table 2.** Comparison of the level of AI and Big Data integration and the impact on the performance of the companies analyzed

| Company | Field | Level of AI &Big Data integration | Digital implementation efficiency |
|---|---|---|---|
| Banca Transilvania | Banking | Advanced (BT Pay, Druid AI, virtual assistant DAVID) | High |
| Electrica SA | Energy | Moderate (BI, digitization RPA) | Medium |
| Romgaz | Natural gas | Low (slow digitization, limited AI) | Low |
| eMAG | Online retail | Very advanced (AI for personalization, logistics, support) | High |
| Dedeman | Physical retail | Medium (ERP, partial digitization) | Stable |

Source: author's compilation according to the financial statements of the analyzed companies

The following section highlights the specific strategies used by each company in the transition to an intelligent operating model. These approaches reflect both the opportunities specific to each sector and the challenges they faced in the digital transformation process. Moreover, these strategies were based on rigorous data analysis to ensure that decisions were as informed as possible and adapted to the dynamic market context. In the banking sector, the pressure to digitize has prompted a rapid response from market leaders. Following an extensive process aimed at simplifying the digital customer experience throughout 2025, BT Pay has become the sole application through which individual customers can access Banca Transilvania's banking services (see BT, *milestones*, 2025). In the internal sphere, Banca Transilvania leverages Druid AI through the intelligent virtual assistant DAVID to enhance internal operations by automating processes, reducing errors, and improving efficiency and collaboration among employees (see druidai.com).

**Table 3.** The impact of implementing AI and Big Data in five large companies in Romania

| Company | Sales (mil. RON) | Net profit (mil. RON) | AI & Big Data impact (summary) |
|---|---|---|---|
| Banca Transilvania | 6,437 (2023 year) mil. / 8,224 (2024 year) mil. | 2,491 mil. / 3,532 mil. | Advanced digitization, fast and efficient financial decisions |
| Electrica SA | 1.4 mil. / 13.6 mil. | 620 mil. / 377 mil. | Network optimization, loss reduction through predictive analytics |
| Romgaz | 9,002 mil. / 7,929 mil. | 2,812 mil. / 3,206 mil. | Optimized production and reduced costs through AI |
| eMAG | 7,720 mil. / 8,993 mil. | 119.1 mil. / -191.5 mil | Personalized offers and efficient logistics with AI |
| Dedeman | 11.546 mil. / 12.294 mil. | 1.535 mil. / 1.637 mil. | Inventory management and quick decisions with Big Data |

Source: Author's own processing according to the financial statements of the analyzed companies (see BT, ElectricaSA, Romgaz, eMAG, Dedeman financial statements)

The data from *Table 3* has been taken and calculated based on the companies' official annual reports (2023), supplemented by sector studies and market analyses published in 2023 and 2024. Table 3 demonstrates a clear link between digital maturity and financial outcomes in the Romanian market, where high-adoption leaders like Banca Transilvania and eMAG utilize AI to drive sales growth and operational efficiency. In contrast, companies with lower or moderate integration levels, such as Romgaz or Electrica SA, focus on specific areas like network optimization or production costs to maintain stability. This variation underscores that the depth of AI and Big Data implementation is a key differentiator for corporate performance and strategic efficiency within the local context.

Also, in this study, we analyzed how major international players such as JPMorgan (finance), Enel (energy), ExxonMobil (energy and oil), Amazon (e-commerce), and Home Depot (retail) use technologies to optimize their performance and address global market challenges. Compared to the Romanian companies analyzed in similar industries, these corporations demonstrate an advanced degree of digital maturity, applying sophisticated AI solutions and Big Data analytics that enable them to innovate, manage risk, and deliver a superior customer experience in a highly competitive environment.


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**Table 4.** The impact of AI and Big Data on leading global companies

| Company | Sales (mil. USD) | Net profit (mil. USD) | AI & Big Data impact (summary) |
|---|---|---|---|
| JPMorgan | 158,104 mil. / 177,556 mil. | 49,552 mil. / 58,471 mil. | Advanced financial analysis and rapid AI-based decisions |
| Enel | 103,220 mil. / 105,840 mil. | 3,720 mil. / 7,580 mil. | Energy optimization and consumption forecasts using Big Data |
| ExxonMobil | 334,697 mil. / 339,247 mil. | 36,010 mil. / 33,680 mil. | Production monitoring and risk management with AI |
| Amazon | 574,785 mil. / 637,959 mil. | 30,425 mil. / 59,248 mil. | Optimized logistics, personalized offers with AI |
| Home Depot | 152,700 mil. / 159,500 mil. | 15,143 mil. / 14,806 mil. | Inventory management and demand analysis using Big Data |

Source: Author's own processing according to the annual report of the analyzed companies (see JPMorgan, Enel, ExxonMobil, Amazon, HomeDepot annual report)

Values expressed in euros (only the Enel case had data expressed in euros) were converted into US dollars using the average annual EUR/USD exchange rate (approximately 1.08) for the years 2023 and 2024, to ensure international comparability of financial indicators. *Table 4* illustrates the strategic advantage of global corporations like Amazon and JPMorgan, which leverage advanced AI and Big Data to manage massive revenue streams and complex risk environments. These international entities exhibit a superior degree of digital maturity, enabling them to optimize logistics, energy consumption, and financial decision-making on a scale that significantly enhances their global competitiveness. Ultimately, the data confirms that sophisticated technological integration is fundamental for sustaining high net profits and operational resilience in developed markets.

## V. CONCLUSIONS

The results of this exploratory qualitative study demonstrate that the adoption of artificial intelligence and Big Data technologies has become a determining factor in the transformation of financial decision-making processes, providing organizations with the ability to process data in real time and strengthen operational efficiency. The analysis indicates a direct correlation between the degree of digital maturity and financial results, highlighting that the leaders in technology adoption on the Romanian market, such as Banca Transilvania and eMAG, use artificial intelligence to stimulate sales growth and strategic efficiency. In contrast, companies with a lower or moderate level of integration, such as Romgaz, record more modest performances, focusing on punctual optimizations to maintain stability. By automating repetitive tasks and reducing human errors, these technologies enable a necessary transition from retrospective analyses to predictive and prescriptive approaches, essential for identifying opportunities and risks before they materialize.

It is important to note that the findings of this exploratory study are indicative and based on a limited sample of companies; therefore, they should not be interpreted as statistical generalizations. However, they provide valuable insights into the digital transformation trajectories in emerging versus developed financial contexts.

The contextual comparison with large international corporations, such as JPMorgan, Amazon or Enel, reveals a digital maturity gap compared to the emerging context, with global players demonstrating a superior capacity to manage massive revenue streams and complex risk environments through sophisticated AI solutions. This advanced technological integration is presented as fundamental to maintaining high profitability and operational resilience in developed markets. However, the success of integration does not depend exclusively on financial investments in technology, but is closely linked to the existence of a strategic vision, an organizational culture oriented towards innovation and rigorous ethical governance.

Despite the obvious benefits offered by machine learning algorithms, the study concludes that traditional methods and professional judgment remain indispensable pillars of the decision-making process. Human experience provides a framework of balance and verification that prevents exclusive reliance on algorithms that, although advanced, can be vulnerable to modeling errors or data limitations. At the same time, the adoption of these technologies involves significant challenges related to data privacy, cybersecurity risks and the need for interpretability of complex models, which imposes the need for clear internal policies and updated regulatory frameworks. Finance professionals must be prepared not only to use the new tools, but also to deeply understand their implications to ensure responsible and sustainable corporate governance.

Looking ahead, it is recommended that organizations pursue a strategic and gradual integration of artificial intelligence and big data solutions, supported by constant investments in digital infrastructure, such as ERP systems, and in the continuous development of professional skills. Future research directions should focus on exploring explainable artificial intelligence techniques and developing frameworks that facilitate cross-institutional data integration. Ultimately, combining intelligent algorithms with a robust data infrastructure is the


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optimal path to a more informed, efficient and resilient financial decision-making process in the face of dynamic market changes.

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