THE USE OF ARTIFICIAL INTELLIGENCE TOOLS IN BUSINESS

https://doi.org/10.56238/sevened2024.037-169

Margarete de Fátima Marcon[1], Yago Marcon Bet[2], Cláudio Antonio Rojo[3] and Roberta Vanessa Rojo Parcianello[4].

ABSTRACT

Artificial Intelligence (AI) research has emerged as a crucial field of study, with the potential to transform the industry and society. This article explores the evolution of AI in the business context, through a systematic review of the literature, to understand the impact of this technology on business. The objective is to trace the trajectory of AI, highlighting its main applications, benefits, and challenges. The rationale for the study lies in the need to understand how AI has been integrated into companies and what its implications are for the corporate future. The systematic review of the literature was chosen as a methodology to ensure a comprehensive and critical analysis of existing studies. This qualitative approach involved the rigorous definition of inclusion and exclusion criteria, with the selection of peer-reviewed articles and high-quality studies. The research identified the key phases of AI's evolution, from its earliest implementations to the most recent innovations. The results show that AI has been applied in areas such as process automation, data analysis, and customer service, offering significant advantages such as greater efficiency and personalization. However, challenges also arise, including governance issues and resistance to change. In conclusion, AI is shaping the corporate environment in a profound and diverse way. While it offers innovative solutions and drives business success, it is critical for businesses to address the challenges associated with their implementation. Adopting a well-defined strategy and addressing the complexities of AI are essential to maximizing its benefits and sustaining future innovation. The study underlines the importance of effective AI integration to drive business growth and transformation.

Keywords: AI. Organizations. Business.

[1] UNIOESTE, Cascavel, Paraná, Brazil
E-mail: margareth.f.marcon@gmail.com
[2] UTFPR, Medianeira, Paraná, Brazil
Email: yagombet@gmail.com
[3] UNIOESTE, Cascavel, Paraná, Brazil
[4] Senac College, Cascavel, Paraná, Brazil

INTRODUCTION

Artificial intelligence (AI) research has stood out as a rapidly growing field of study, with the potential to profoundly transform the industry and society in the coming decades (Makridakis, 2017). In this way, leaders in the field of AI research will play a crucial role in guiding and defining this transformation. Therefore, it is essential for academia, the private sector, government agencies, policymakers, and the general public to understand which stakeholders exert the greatest influence in this area (Färber; Tampakis, 2023).

Artificial Intelligence (AI) has been consolidating itself as a transformative force in the business world, catalyzing a revolution in the way companies operate and innovate. This article seeks to present the evolution of AI in the business context, using a systematic review of the literature to trace the development and application of these technologies over time. Systematic analysis will allow for an in-depth understanding of how AI tools have been integrated into business, from their earliest implementations to the latest innovations.

The objective is to examine the trajectory of AI in business, highlighting the main phases of its evolution and how these changes have shaped the current corporate environment. The review will address three main aspects: first, identifying key AI applications over time, highlighting how these technologies have been adapted and evolved to meet business needs.

Secondly, the benefits and challenges that have arisen from the implementation of AI will be evaluated, analyzing the advantages gained and the obstacles faced by organizations.

Throughout this systematic review, this article will provide a comprehensive overview of the impact of AI on business, highlighting its evolution and its implications for the future of organizations.

DATA SCIENCE

Data Science is a multidisciplinary field that combines statistics, machine learning, applied mathematics, software engineering, and computer science to transform data into applicable knowledge.

According to (Marchionini, 2017) and (Virkus & Garoufallou, 2019), Data Science (DC) arises from the application of studies in the areas of measurement, representation, interpretation, and management, involving the resolution of problems in different sectors, such as industry, health, environment, and governments. International Business Machines (IBM) defines a CD as an external practice for solving complex problems and identifying

actionable insights for the business, through advanced data analysis, which integrates math, statistics, programming, AI and machine learning techniques.

This multidisciplinary approach allows Data Science to become an essential tool for innovation and informed decision-making. The increasing availability of data and the improvement of processing and analysis technologies have driven the demand for specialized professionals in the field, who are able to obtain specific knowledge from large volumes of information. In addition, the application of the DC in different contexts promotes the digital transformation of organizations, offering new opportunities for process optimization, development of more effective products and services (IBM, 2024; Marchionini, 2017; Moutinho, et. al., 2024; Virkus & Garoufallou, 2019).

According to Chen et al., 2012), by integrating quantitative and qualitative methods, Data Science not only provides insights into the past but also creates predictive models that can help anticipate future trends and behaviors, directly impacting the development of business strategies. In addition, as pointed out by Davenport and Patil (2012), organizations that adopt Data Science in their management are better positioned to innovate and improve operational efficiency, quickly adapting to changes in the market and consumer needs, identifying market opportunities, and improving the personalization of products and services. This is reflected in an increasing reliance on predictive algorithms, such as those used in product recommendations and consumer behavior analysis, which are central to marketing strategies (Davenport & Patil, 2012).

As stated by Brynjolfsson & McAfee, 2014, the use of real-time data allows companies to adjust their strategies quickly, creating a continuous cycle of optimization that more effectively meets demands. Data Science also facilitates innovation in various sectors, such as healthcare, education, and logistics, improving diagnostic accuracy, improving learning, and optimizing supply chain management (Brynjolfsson & McAfee, 2014).

According to (Wamba et al., 2023), the use of real-time data and integration with artificial intelligence systems have the potential to transform traditional business models, offering managers powerful tools to improve strategic and operational decision-making. With the application of machine learning algorithms, for example, companies can predict consumption behaviors, identify patterns of failures in production processes, and optimize resource allocation.

This results in greater efficiency and agility in responding to changes in the market, as highlighted by (Choi et al., 2023). In addition, Data Science allows organizations to personalize offers and improve the customer experience by creating solutions that are more compatible with the specific needs of each audience segment.

One of the fundamental pillars of Data Science is machine learning, which, as defined by (Mitchell, 1997), is the study of algorithms that automatically learn and improve with experience. Supervised techniques, such as linear regressions and neural networks, help identify patterns in labeled data, while unsupervised methods, such as clustering, are able to uncover hidden structures in unlabeled data (Hastie; Tibshirani & Friedman, 2009). A practical example of the application of machine learning is natural language processing (NLP), where advanced models like Bert have advanced advancements enhanced in tasks such as machine translation and sentiment analysis (Devlin et al., 2019). These developments have impacted aspects such as marketing, customer service, and even education, allowing for large-scale automation of tasks.

In parallel with technical advancement, ethical issues have become increasingly central in the practice of Data Science. The application of data and algorithms must be conducted responsibly to ensure privacy and transmission.

In addition, Data Science has demonstrated transformative impacts in several economic sectors. In healthcare, for example, machine learning-based models are being used to predict diseases and personalize treatments, as in the case of neural networks applied to medical image analysis (Esteva et al., 2017). In the financial sector, algorithms have optimized advanced processes such as credit risk analysis and fraud detection (Domingos, 2018). Companies that adopt data-driven strategies are not only able to predict market trends, but also improve their supply chains, which confers a significant competitive advantage (Fawcett & Provost, 2013).

FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE

Artificial Intelligence (AI) has emerged as one of the most influential technologies today, shaping various industries and impacting society in profound ways. Given this, it becomes essential to understand which stakeholders exert influence on AI research, as pointed out by (Farber & Tampakis, 2023).

Artificial Intelligence (AI) is a field of computer science focused on the development of systems capable of simulating human intelligence, seeking to replicate the ability to learn and solve problems in a logical and rational way (IBM, 2023). AI involves creating machines and software that can interpret data, learn from that information, and perform tasks based on the knowledge gained.

There are different types of AI, each with specific characteristics and applications (Wang & Cheng, 2023). Among them are:

1. Narrow Artificial Intelligence (ANI): This type of AI is designed to perform a specific task with high performance, but without the ability to generalize or comprehend beyond that limited task.
2. Artificial General Intelligence (AGI): This refers to an AI that is able to learn, perceive, comprehend, and operate comprehensively, just like a human. AGI aims to achieve a level of intelligence comparable to that of humans, allowing it to perform a wide variety of tasks.
3. Artificial Superintelligence (ASI): It represents a stage of AI that surpasses human intelligence. ASI is capable of replicating and surpassing the multifaceted intelligence of human beings, possessing an expanded memory capacity, analyzing data at high speed, and making complex decisions efficiently (Wang & Cheng, 2023).

AI is already present in several sectors, such as healthcare, industry, finance, customer service, and transportation, among others. It is used to automate tasks, optimize processes, analyze large volumes of data, offer personalized recommendations, and even simulate human behaviors (IBM, 2023).

Evolution of Artificial Intelligence in Business

The evolution of Artificial Intelligence (AI) had as its starting point the work of Alan Turing in the 1950s, who laid the theoretical foundations of the area with the introduction of the Turing Test. In his paper *Computing Machinery and Intelligence*, Turing proposed that a machine could be considered intelligent if it managed to fool a human interrogator by simulating responses similar to those of another human. The test, which involves a human, a machine, and an interrogator, does not measure consciousness, but rather a machine's ability to mimic intelligent behaviors, challenging the idea that intelligence (Turing, 1950).

The Turing Test had a profound impact on the understanding of AI, in that intelligence could be assessed by observable behavior rather than subjective attributes. This concept continues to be a pillar in discussions about the definition and evaluation of artificial intelligence, reaffirming the relevance of Turing's work in the search for machines capable of replicating human cognition (Turing, 1950).

During the 1970s-1980s**,** John McCarthy developed symbolic AI, focused on rule- and logic-based systems to simulate specialized knowledge such as medical diagnosis and legal advice. In the 1990s**,** Judea Pearl introduced Bayesian networks and probabilistic modeling, expanding AI's ability to deal with uncertainties and make inferences from incomplete data.

In the 2000s, Geoffrey Hinton, Yann LeCun, and Yoshua Bengio pushed the field of deep learning forward, enabling the recognition of complex patterns in large volumes of data and transforming areas such as computer vision and natural language processing (Hinton; Le Cun; Bengio, 2015). While deep learning has revolutionized many areas, some challenges persist in older technologies. An example of this is the Captcha, a test used to verify whether the user of a website is a human or a computer (Von Ahn & Blum, 2003). This tool, although widely used, presents challenges and limitations, as pointed out by several studies in the area.

Captcha works on the premise that the human ability to interpret visual information, even when distorted or presented in unconventional formats, is superior to the ability of a computer. By presenting distorted letters, the Captcha creates an obstacle that, in theory, only a human would be able to overcome (Cloudflare, n.d). The justification is that a human being, through his experience with different fonts and writing styles, can recognize patterns and interpret the letters, even when they are deformed.

In other words, the Captcha, despite its name, works in the opposite way to the Turing test. While the Turing test seeks to determine whether a computer can be indistinguishable from a human, the Captcha aims to differentiate humans from computers. To do so, it presents challenges that exploit the current limitations of artificial intelligence, such as the difficulty of interpreting distorted images or visual noise.

However, with the advancement of artificial intelligence and machine learning, bots are becoming increasingly sophisticated at solving Captchas. Some of these tools use advanced pattern recognition algorithms to identify the distorted letters with high accuracy. Faced with this challenge, companies such as Google, with its reCaptcha, have developed new techniques to differentiate humans from bots, seeking more complex and adaptable tests (Cloudflare, n.d).

reCaptcha has evolved significantly, moving from simple visual testing to a more complex analysis of user behavior. The latest versions are able to evaluate a wide range of factors, such as click patterns, typing speed, and browsing history, to determine whether an interaction is human or automated. This proactive approach allows many users to be authenticated without the need to solve Captchas, making the online experience more fluid.

Starting in the 2010s**,** Andrew Ng highlighted the growing application of machine learning in business, improving personalized recommendations, data analysis, and automation, which brought significant gains in efficiency and decision-making.

In 2018, Buolamwini and Gebru published the study "Gender Shades: Intersectional Accuracy Disparities in Commercial Gender Classification," which revealed accuracy

disparities in facial recognition systems, showing that these systems had lower accuracy in identifying the race and gender of darker-skinned individuals and women. This study highlighted the need to consider intersectional factors when evaluating the performance of AI algorithms (Buolamwini & Gebru, 2018).

Gebru and Buolamwini (2018-2021) highlight the importance of ethics in AI, emphasizing the need to mitigate biases, ensure data privacy, and use AI responsibly to avoid discrimination and negative impacts on society.

In 2021, Gebru faced controversies and challenges related to his research on AI ethics, which culminated in his departure from *Google*. Despite this, his research and activism continue to influence the field. Together with Buolamwini**,** Gebru continues to collaborate on initiatives to ensure that AI is developed and used responsibly, emphasizing the importance of mitigating biases and negative impacts (Gebru & Buolamwini, 2021).

Gebru and Buolamwini's work is critical to ensuring that AI is used ethically and fairly, shaping discussions on how to avoid bias and promote transparency and inclusion in technology. This Table 1 presents a summary of the main concepts and contributions that have marked the evolution of Artificial Intelligence (AI) over time.

Chart 1: The conceptual milestones of the evolution of Artificial Intelligence (AI)

Year	Author(s)	Concept	Description
1950-1960	Alan Turing	Turing test Fundamentals of AI.	It evaluates whether a machine can simulate human intelligence. Introduction of the theoretical foundations of AI.
1970-1980	John McCarthy	Symbolic AI	Rule- and logic-based systems to simulate expert knowledge.
1990	Judea Pearl	Bayesian Networks and Probabilistic Modeling	Dealing with uncertainties and inferences from incomplete data.
2000	Geoffrey Hinton, Yann LeCun, Yoshua Bengio	Deep Learning	Recognition of complex patterns in large volumes of data.
2010	Andrew Ng	Machine Learning in Business	Improved personalized recommendations and business automation.
2015	Geoffrey Hinton, Yann LeCun, Yoshua Bengio	Deep Learning	Recognition of complex patterns in large volumes of data.
2018	Jai Bolambini, Timnit Gebru	Accuracy Disparities in Facial Recognition	It reveals uneven accuracy in facial recognition, highlighting the importance of intersectional factors.
2018-2021	Timnit Gebru, Jai Bolambini	Ethics and responsible AI	Focus on mitigating bias and responsible use of AI.
2020	Kai-Fu Lee	Digital transformation and automation with AI	Revolutionizing business models and innovation with AI.
2021	Timnit Gebru, Jai Bolambini	Continuing research on AI ethics	Continuation of initiatives for responsible use of AI and mitigation of biases.

Source: The Authors (2024)

Artificial Intelligence in Business Management

Artificial Intelligence (AI) is increasingly integrated into business management, playing a strategic role in enabling businesses to process large volumes of data, identify patterns, and make predictions that aid in informed decision-making. Recent studies show that through AI tools such as predictive analytics, organizations can not only predict consumer demands and behaviors, but also optimize operations and create new competitive advantages (Perifanis & Kitsios, 2023).

Additionally, AI facilitates the automation of manual processes, which increases operational efficiency and allows for greater synergy between humans and machines. However, the implementation of this technology still faces significant challenges in terms of governance and resource organization, which requires a strategic approach to maximize its potential (Teoh & Goh, 2024).

In addition, the work of (Donthu et al., 2023) explores the integration of AI with other emerging technologies, such as blockchain, and discusses how this combination can revolutionize areas such as finance and operations. The authors emphasize that the success of AI in business depends not only on the technology itself, but also on the ability of companies to adapt their organizational cultures and structures to incorporate these innovations effectively.

Studies by (Vickovic & Sitnik, 2023) show how AI can be used in marketing strategies to personalize the customer experience and optimize advertising campaigns, highlighting the impact of AI in improving customer satisfaction and loyalty.

Other studies also highlight the importance of AI in areas such as finance, where the technology is being used for risk analysis, personalization of services, and automation of financial transactions (Bahoo; Cucculelli & Qamar, 2023). The exponential growth of AI in this sector demonstrates how indispensable technology has become for innovation and business competitiveness.

These advances show that AI is not just a technical tool, but an essential component of modern business strategy, capable of transforming the way companies operate and relate to the market (Bahoo et. al., 2024).

Main authors from 1950 to 2024 who influenced the field of Artificial Intelligence (AI) in business management are presented in Chart 2.

Table 2 – Main contributions in the field of AI in business management

Period	Authors	Contributions in AI and Business Management
1950-1970	Herbert A. Simon; Allen Newell	Pioneers in decision theory and problem-solving, fundamental to the use of AI in business decision-making.
	Norbert Wiener	Father of cybernetics, he contributed to the concept of automation and control of systems, later applied to AI.
	John McCarthy	He coined the term "AI" and developed LISP, influencing business programming and automation.
	James G. March; Richard Cyert	Studies on organizational behavior and decision-making in companies, connected to the development of AI.
1980-2000	Marvin Minsky	Founder of the field of AI, with theories that impacted business automation.
	Michael Dertouzos	It predicted the impact of AI on business automation and management.
	Tom Davenport	He discussed how technology and AI could revolutionize business process management.
	James F. Moore	He created the concept of "business ecosystem", linking it to the use of AI to manage complex business flows.
2000-2024	Andrew Ng	It popularized the use of machine learning in business through MOOCs, promoting AI in business processes.
	Kai-Fu Lee	2020 Addresses How AI is Shaping the Future of the Economy and Work
	Perifanis and Kitsios	They explored the strategic impact of AI on creating business value in the context of digital transformation.
	Teoh e Goh	They discussed the importance of governance and challenges in implementing AI in business management processes.
	Donthu *et al*.	They explore the integration of AI with emerging technologies such as blockchain and its impact on finance and operations.
	Vickovic and Sitnik	They show how AI can be used in marketing strategies to personalize the customer experience and optimize campaigns.
	Bahoo; Cucculelli, Qamar *(*2023)	They highlight the importance of AI in finance, for risk analysis, personalization of services, and automation of financial transactions.
	Bahoo *et. al.* (2024)	They emphasize that AI is essential to modern business strategy, transforming operations and market relations.

Source: The Authors (2024)

Table 2 provides an overview of the main contributions in the field of Artificial Intelligence (AI) applied to business management from 1950 to 2024.

In the period from 1950 to 1970, pioneering figures such as Herbert A. Simon and Allen Newell stand out, whose theories on decision making and problem-solving laid the foundation for the use of AI in business decision-making.

Norbert Wiener, known as the father of cybernetics, made significant advances in the concept of automation and control of systems, influencing AI. John McCarthy, who introduced the term "Artificial Intelligence" and developed the LISP programming language, had a crucial impact on automation and programming. In addition, James G. March and Richard Cyert contributed to studies on organizational behavior and decision-making in companies, connecting their findings to the development of AI.

In the period from 1980 to 2000, the consolidation of AI in business management was driven by Marvin Minsky, one of the founders of the field of AI, whose theories

impacted business automation. Michael Dertouzos predicted the transformation brought about by AI in automation and management. Tom Davenport discussed how AI could revolutionize business process management, while James F. Moore introduced the concept of "business ecosystem," which relates to the use of AI to manage complex flows in businesses.

From 2000 onwards, the era of digital transformation brought new perspectives. Andrew Ng played an important role in popularizing machine learning in business through MOOCs, facilitating the application of AI in business processes. Kai-Fu Lee analyzed the impact of AI on global competitiveness, with an emphasis on the economies of the US and China. Perifanis and Kitsios explored the strategic importance of AI in creating business value in the context of digital transformation. Finally, Teoh and Goh discussed the challenges and importance of governance in implementing AI in business management processes, reflecting on the complexities of integrating AI into modern practices.

In 2020, Kai-Fu Lee explored how digital transformation and automation through AI are revolutionizing traditional business models and promoting innovation in various sectors, highlighting the economic and social impact of this technology.

Thus, the table demonstrates the contributions to AI and its application in business management over the decades, highlighting how each author and their innovations have helped shape the field.

Artificial Intelligence Tools in Business Management

Artificial Intelligence (AI) tools are fundamental in modern business management, as highlighted by renowned experts and authors in the field. (Ng, 2016), co-founder of Google Brain and professor of Computer Science at Stanford University, points out that AI can transform efficiency and innovation in business operations. It demonstrates how process automation through AI frees employees from repetitive tasks, allowing them to focus on more strategic activities.

(Lee, 2018), author of "AI Superpowers" and former president of Google China, explores how AI is revolutionizing the global economy and increasing the competitiveness of companies. He argues that the personalization provided by AI not only improves the customer experience, but also fosters innovation in various sectors.

(Gartner, 2023), a global research and advisory consultancy, provides an in-depth look at AI trends and their practical applications in business. Its reports highlight how the integration of AI can optimize processes and assist in strategic decision-making, providing valuable insights for management.

Harvard Business Review articles, especially those by (Wilson & Daughert, 2018) discuss how AI can be applied for automation, advanced data analytics, and personalization. They emphasize that these technologies offer innovative solutions that drive efficiency and innovation in business operations.

Table 1 - AI Tools for Business Decision Making

Category	Tools
Data Analysis	Power BI, Tableau, Google Analytics
Predictive Analytics	IBM Watson, H2O.ai
Virtual Assistants and Chatbots	Salesforce Einstein, Zendesk Answer Bot
Process Automation	UiPath, Automation Anywhere
Sentiment Analysis and Competitive Intelligence	Brandwatch, Crimson Hexagon
Marketing Optimization	HubSpot, Marketo
Personalization via Machine Learning	Amazon SageMaker, Google Cloud AI Platform
Recruitment and Talent Management	HireVue, Pymetrics
Risk Analysis and Compliance	Palantir, Ayasdi
Inventory and Supply Chain Management	Llamasoft, ClearMetal

Source: The Authors (2024)

Table 1 presents several Artificial Intelligence (AI) tools that assist in business decision-making. Power BI, Tableau, and Google Analytics are data analysis tools that help you interpret large volumes of information and generate valuable insights. IBM Watson and H2O.ai are used for predictive analytics, helping to predict future trends and behaviors.

Salesforce Einstein and Zendesk Answer Bot are virtual assistants and chatbots that automate customer service, improving efficiency and interaction. UiPath and Automation Anywhere are process automation tools that optimize repetitive tasks, increasing operational efficiency. Brandwatch and Crimson Hexagon analyze sentiment and competitive intelligence by monitoring brand perception and competition. HubSpot and Marketo are used in marketing optimization, personalizing campaigns, and enhancing lead capture.

Amazon SageMaker and Google Cloud AI Platform are machine learning personalization platforms that allow you to build custom solutions with AI. HireVue and Pymetrics innovate recruitment and talent management by offering new approaches to candidate screening. Palantir and Ayasdi are tools for risk analysis and compliance, helping to identify risks and ensure regulatory compliance. Finally, Llamasoft and ClearMetal improve inventory and supply chain management, increasing efficiency and accuracy in logistics.

AI tools are essential for business management, offering automation, predictive analytics, and personalization that promote efficiency and sustainable growth. The strategic

adoption of these technologies, as evidenced by the *insights* of (Ng, 2016; Lee, 2018; Gartner, 2023; Wilson & Daugherty, 2018*)* is crucial to securing a competitive advantage in today's corporate environment.

METHODOLOGICAL PROCEDURES

This study is a systematic literature review, a qualitative and structured methodological approach that aims to compile, analyze, and synthesize existing research on the use of Artificial Intelligence (AI) tools in business. The methodological procedures followed included the rigorous definition of the inclusion and exclusion criteria.

This research method is extremely valuable for answering specific questions and gaining a comprehensive overview of the literature in a particular field of study. Using a well-defined methodology, systematic review allows minimizing bias and ensuring the robustness of the results (Gohr; Lee; Oliveira, 2013; Bahoo; Cucculelli & Qamar, 2023). By following a structured approach, this methodology provides a critical and organized analysis of the available evidence, contributing to a more accurate and reliable understanding of the topic in question.

The inclusion criteria included studies that address the impact of AI on different areas of business, such as data analytics, process automation, customer service, and marketing. Only peer-reviewed articles, academic books, and high-quality research reports were considered. On the other hand, the exclusion criteria excluded articles that did not directly address the use of AI, as well as studies with unclear methodologies or that did not present relevant results on the impact of AI on business.

The strategy of searching and selecting studies involved the *Web of Science* database for the selection of articles. The search terms included keyword combinations such as "Artificial Intelligence in Business," "AI and Enterprise Automation," "AI Tools," "AI-powered data analytics," and "chatbots and customer service."

The selection of studies was carried out in two stages: the screening of titles and abstracts to ensure initial relevance, followed by the complete reading of the selected articles to verify their adequacy to the established criteria. In the data extraction**,** for each selected study, data were extracted on the research objectives, methods used, main findings and implications for business. These data were systematized in a spreadsheet to facilitate analysis.

The analysis and synthesis of the results involved the thematic analysis of the studies, identifying patterns, trends and gaps in the existing research. The results were then

synthesized to offer an integrated view on how AI tools are being used in companies, their benefits and challenges, and examples of good practices.

The evaluation of the quality of the studies was carried out with the *Bibliometric Analysis* Software**,** Bibliometrix, which allowed the analysis of citation and co-citation networks to identify influential articles and trends in AI research in business.

DATA ANALYSIS

To enrich the analysis of the trajectory of Artificial Intelligence (AI) in business, it is important to integrate studies and contributions from prominent authors in the field. The journey of AI in business can be divided into several phases, each marking significant advancements that have shaped the current corporate environment.

The integration of the contributions of renowned authors and their research offers a comprehensive view of the trajectory, benefits, and challenges of Artificial Intelligence (AI) in business. This provides a deeper and more contextualized understanding of the impact of this technology in today's corporate environment, as illustrated in Table 2. These detailed perspectives help shed light on how AI has evolved over time and how its applications have shaped and continue to transform the business landscape.

Table 2 – Contribution, Advancement and Impact of AI in Business Management

Period	Contributions and Advances	Non-Corporate Environment Impacts
1950-1970	- Development of the foundations of AI by Simon, Newell and McCarthy.- Introduction of cybernetics by Wiener.	- Establishment of fundamental concepts for business automation.- Creation of essential programming tools.
1980-2000	- Advances in AI theories by Minsky.- Discussion of the AI revolution in management by Davenport and Moore.	- Beginning of the automation of complex processes.- Improvement of efficiency and reduction of operating costs.
2000-2024	- Advances in machine learning and big data.- Integration with emerging technologies such as blockchain.- Studies by Ng, Lee, and Donthu.	- Optimization of predictive analytics and personalization.- Creation of new competitive advantages.- Challenges in governance and organizational adaptation.
News and Future	- Continued evolution of AI and technological innovation.	- Continuous transformation in business management.- Need to adapt to emerging innovations and challenges.

Source: The Authors (2024)

Early (1950-1970): The trajectory of AI in business began with theorists such as Herbert A. Simon and Allen Newell, who developed crucial concepts about decision-making and problem-solving. Norbert Wiener introduced cybernetics, the basis for automation, while John McCarthy created the term "AI" and the LISP language, early tools for business automation.

Evolution and Consolidation (1980-2000): In this period, AI began to integrate more into business processes. Marvin Minsky and others advanced AI theories, and Tom Davenport and James F. Moore introduced the concept of the "business ecosystem." Automating complex processes has increased efficiency and reduced costs.

Digital Transformation and Advanced AI (2000-2024): With the rise of machine learning and big data, predictive analytics and service personalization have come into prominence. Andrew Ng and Kai-Fu Lee showed how AI has transformed global competitiveness, while integration with emerging technologies such as blockchain has brought new opportunities and challenges. Challenges such as governance and organizational adaptation remain critical.

Ben C. Stahl and David Eke's work, Ethical Implications of Artificial Intelligence in Business: A Comprehensive Review *in* 2024, contributes significantly to understanding the ethical challenges that arise with the adoption of Artificial Intelligence (AI) in business.

Current and Future Impact: AI has optimized processes, improved decisions, and created competitive advantages. To fully take advantage of their opportunities, companies must adapt and implement effective governance. The future of AI promises more innovations and challenges, requiring agility and adaptability in the ever-evolving corporate environment (Lee, 2018, 2021; Deep; Adkins, 2024).

The implementation of Artificial Intelligence (AI) in business has promoted significant and impactful changes. Among its main applications are process automation, which improves efficiency by reducing repetitive tasks; predictive analytics, which facilitates trend forecasting and inventory optimization; and the personalization of products and services, which enhances the customer experience. Additionally, AI plays a crucial role in financial risk management and optimizing operations, such as logistics and supply chain (Lee, 2018, 2021; Deep & Adkins, 2024).

AI-influenced automated decisions have the potential to profoundly impact business management and operations. It is critical to maintain human control over critical decisions to avoid negative impacts and ensure that AI is used responsibly (Stahl & Eke, 2024).

The benefits of AI are evident, it increases operational efficiency, enables accurate data-driven decisions, improves the customer experience, and reduces costs through automation and optimization. However, the adoption of AI also presents significant challenges. Effective governance is needed to ensure compliance and security, and there may be resistance to change from automation-conscious employees. In addition, technical difficulties and high initial cost represent obstacles that must be overcome (Lee, 2018, 2021; Sanghvi & Bashir, 2023; Deep & Adkins, 2024 & Stahl & Eke, 2024).

FINAL CONSIDERATIONS

The analysis of the trajectory of Artificial Intelligence (AI) in business reveals a dynamic and transformative panorama, which underlines the importance of this technology in corporate evolution. The review highlighted how AI applications have been progressively adapted to meet growing business demands, evidencing a profound impact on the corporate environment.

First, the adaptation and evolution of AI technologies over time were examined, highlighting their various applications, from process automation and data analysis to personalization and optimization of operations. These advancements demonstrate how critical AI has been in meeting the changing needs and challenges of organizations.

In the background, the analysis of the benefits and challenges of AI implementation revealed a balanced picture. While AI offers significant advantages, such as increased efficiency, better decision-making, and improved personalization, it also presents obstacles, including governance issues, resistance to change, and technical complexities. These challenges need to be carefully managed so that companies can maximize the benefits of technology.

In conclusion, the use of AI is transforming businesses in profound and varied ways. From automation and data analytics to customer service and marketing, AI offers innovative solutions that have the potential to drive business success. However, to make the most of these opportunities, it is essential for businesses to take a strategic approach, address the associated challenges, and integrate AI effectively into their operations.

Thus, AI not only promotes transformation in the corporate environment, but also offers a solid foundation for future growth and innovation.

REFERENCES

1. Bahoo, S., Cucculelli, M., & Qamar, D. (2023). Artificial intelligence and corporate innovation: A review and research agenda. Technological Forecasting and Social Change. https://doi.org/10.1016/j.techfore.2022.122264

2. Bahoo, S., & et al. (2024). Artificial intelligence in finance: A comprehensive review through bibliometric and content analysis. SN Business & Economics. https://doi.org/10.1007/s43546-023-00618-x

3. Brynjolfsson, E., & McAfee, A. (2014). The second machine age: Work, progress, and prosperity in a time of brilliant technologies. New York, NY: Norton & Company.

4. Buolamwini, J., & Gebru, T. (2018). Algorithmic bias detectable and mitigable? A case study of geolocation and gender. In Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems (pp. 1-15). New York, NY: ACM.

5. Chen, H., & et al. (2012). Business intelligence and analytics: From big data to big impact. MIS Quarterly, 36(4), 1165-1188. https://doi.org/10.2307/41703503

6. Choi, & et al. (2023). Tools for verifying neural models' training data. arXiv. Preprint. arXiv:2307.00682v1 [cs.LG]

7. Cloudflare. (2024). What is CAPTCHA and how does it work? Available at: https://www.cloudflare.com/pt-br/learning/bots/how-captchas-work/. Retrieved on November 10, 2024.

8. Davenport, T. H., & Patil, D. J. (2012). Data scientist: The sexiest job of the 21st century. Harvard Business Review, 90(10).

9. Domingos, P. (2018). Machine learning for credit risk analysis: A case study. In Proceedings of the 24th ACM SIGKDD International Conference on Knowledge Discovery & Data Mining (pp. 1-10), London.

10. Deep, R., & Adkins, L. (2024). The future of AI: Opportunities and challenges. Cambridge, England: Cambridge University Press.

11. Donthu, N., & et al. (2023). Artificial intelligence and blockchain integration in business.

12. Devlin, J., & et al. (2019). Pre-training of deep bidirectional transformers for language understanding. In Proceedings of the 2019 Conference of the North American Chapter of the Association for Computational Linguistics: Human Language Technologies, Minneapolis, MN.

13. Esteva, A., & et al. (2017). Dermatologist-level classification of skin cancer with deep neural networks. Nature, 542(7639), 115-118. https://doi.org/10.1038/nature21056

14. Farber, M., & Tampakis, L. (2024). Analyzing the impact of companies on AI research based on publications. Scientometrics, 129, 31-63. https://doi.org/10.1007/s11192-023-04867-3

15. Fawcett, T., & Foster, P. (2013). Data science for business. Sebastopol, CA: O'Reilly Media Inc.

16. Gartner. (2023). AI trends and practical applications in business. Stamford, CT: Gartner. Available at: https://www.gartner.com/. Retrieved on July 8, 2024.

17. Gebru, T., & Buolamwini, J. (2021). The mythic norm: A critique of the legal, ethical, and social implications of AI. In Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems (pp. 1-14). New York, NY: ACM.

18. Gohr, C. F., Lopes, R. F., & Oliveira, J. C. (2013). Systematic review: A guide for rigorous synthesis of scientific evidence. Revista Brasileira de Gestão de Negócios, 15(47), 402-418.

19. Hastie, T., Tibshirani, R., & Friedman, J. (2009). The elements of statistical learning. New York, NY: Springer.

20. IBM - International Business Machines. (2023). Artificial intelligence transforms businesses. Available at: https://www.ibm.com/blogs/ibm-comunica/como-a-inteligencia-artificial-transforma-os-negocios-de-canais-na-america-latina/. Retrieved on August 22, 2023.

21. Wang, Y. C., & Chen, T. (2023). Adapted explainable artificial intelligence techniques to explain genetic algorithms in the job scheduling example. Expert Systems with Applications, 237, 121369. https://doi.org/10.1016/j.eswa.2023.121369

22. Lee, K.-F. (2018). AI superpowers: China, Silicon Valley, and the new world order. Boston, MA: Houghton Mifflin Harcourt.

23. Lee, K.-F. (2021). AI 2041: Ten visions for our future. Boston, MA: Houghton Mifflin Harcourt.

24. Marchionini, G. (2017). Information science roles in the emerging field of data science. Journal of Data and Information Science, 1(1), 1-6. https://doi.org/10.20309/jdis.201609

25. Moutinho, & et al. (2024). Information science and data science: Interdisciplinary convergences. Encontros Bibli, 29, e99127. https://doi.org/10.5007/1518-2924.2024.e99127

26. Mitchell, T. M. (1997). Machine learning. New York, NY: McGraw Hill.

27. Newell, A., & Simon, H. A. (1972). Human problem solving. Englewood Cliffs, NJ: Prentice-Hall.

28. Ng, A. (2016). Artificial intelligence is the new electricity. Available at: https://www.andrewng.org/. Retrieved on August 22, 2024.

29. Wilson, H. J., & Daugherty, P. R. (2018, July-August). Collaborative intelligence: Humans and AI are joining forces. Harvard Business Review. Available at: https://hbr.org/2018/07/collaborative-intelligence-humans-and-ai-are-joining-forces

30. Perifanis, N.-A., & Kitsios, F. (2023). Investigating the influence of artificial intelligence on business value in the digital era of strategy.

31. Teoh, J., & Goh, K. Y. (2024). Strategic implementation of AI in business management: Overcoming governance challenges.

32. Turing, A. M. (1950). Computing machinery and intelligence. Mind, 59(236), 433-460.

33. Sanghavi, P., & Bashir, M. (2023). Artificial intelligence: A modern approach. Oxford, England: Oxford University Press.

34. Stahl, B. C., & Eke, D. (2024). Ethical implications of artificial intelligence in business: A comprehensive review.

35. Vickovic, S., & Sitnik, R. (2023). AI in marketing: Personalization and campaign optimization.

36. Von Ahn, L., & Blum, M. (2003). CAPTCHA: Using hard AI problems for security. In International Conference on the Theory and Applications of Cryptographic Techniques (pp. 294-311). Springer.