

Integrating artificial intelligence, blockchain, and management information systems for business transformation: A bibliometric-content analysis

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Abstract

A cornerstone of modern corporate transformation is the combination of Artificial Intelligence (AI), Blockchain, and Management Information Systems (MIS). This integration provides creative solutions to improve decision-making, operational efficiency, and organizational agility. All three of these technologies are interconnected. An examination of the convergence of these cutting-edge technologies and the impact they have on business operations is presented in this study in the form of a bibliometric-content analysis. Using a dataset consisting of publications that have been reviewed by other researchers and proceedings from conferences, we identify major trends, topic clusters, and research gaps in the existing body of literature. According to the findings, the capabilities of artificial intelligence in predictive analytics, the safe and transparent data management provided by blockchain, and the structured information processing provided by management information systems all work together to encourage sustainable corporate growth and change. Supply chain optimization, modeling of client behavior, and the protection of financial transactions are examples of prominent applications. Interoperability, scalability, and ethical considerations are some of the new challenges that are brought to light by the analysis. These challenges call for further investigation in the future. This study contributes to the academic and practical understanding of how artificial intelligence (AI), blockchain technology, and management information systems (MIS) interact to rethink business strategy and provides insights that can be put into action by policymakers, researchers, and industry practitioners.

Keywords: Artificial Intelligence; Business Integration; Content Analysis; Emerging Trends; Digital Transformation

1. Introduction

In recent years, the integration of Artificial Intelligence (AI) and Blockchain has emerged as one of the most promising technological trends in the business world. Both AI and blockchain have individually revolutionized industries by introducing novel approaches to data processing, security, and decision-making. AI, with its ability to analyze large datasets and make predictions, has transformed sectors like finance, healthcare, and marketing by enhancing decision-making processes and optimizing operational efficiency (Ahmad et al., 2019). On the other hand, blockchain, with its decentralized and transparent nature, has offered businesses a way to secure transactions, manage supply chains, and reduce fraud. However, when these two technologies are combined, their synergistic potential becomes evident, as AI can enhance blockchain's ability to make intelligent decisions while blockchain can provide a secure and transparent foundation for AI systems. The integration of AI and blockchain in business is no longer a futuristic concept but a present

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reality, with many organizations experimenting with or already deploying AI-blockchain solutions (Attaran et al., 2020; Bai et al., 2020). Despite the growing interest, the academic literature on the combined impact of these technologies is still in its infancy. While some studies focus on either AI or blockchain separately, only a limited number of papers have explored the intersection of both in a business context. This research seeks to fill this gap by providing an in-depth analysis of the synergies between AI and blockchain, identifying trends, challenges, and potential opportunities in business settings (Bai et al., 2020).

Moreover, as businesses across the globe increasingly adopt digital transformation strategies, understanding how AI and blockchain can work together to drive innovation is critical. However, while individual technologies have been studied extensively, their combined effect on business operations, decision-making, and competitiveness has not been systematically analyzed. This paper attempts to address this gap by exploring the intersection of AI and blockchain in business through a bibliometric and content analysis of the existing literature (Attaran et al., 2020). The study focuses on identifying the key trends, emerging research areas, and technological advancements that illustrate the growing importance of this integration for businesses seeking to gain a competitive edge. This paper aims to provide a comprehensive understanding of the current state of AI-blockchain integration in business and offer insights that can inform both business practice and future research (Ahmad et al., 2019).

The significance of this study lies in its potential to inform businesses, researchers, and policymakers about the implications of AI-blockchain integration for digital transformation. By identifying key trends and technological innovations, the study provides valuable insights for businesses looking to stay competitive in an increasingly digital world. Furthermore, by addressing the challenges and barriers to integration, the study offers practical recommendations for overcoming these obstacles. For researchers, this paper presents a foundational analysis of the intersection of AI and blockchain, encouraging further investigation into this promising area. Policymakers can also benefit from understanding the regulatory concerns that businesses face when adopting these technologies.

2. Literature Review

Artificial Intelligence (AI) has increasingly become a cornerstone of business innovation, enhancing organizational capabilities in areas such as data analysis, decision-making, and automation. AI encompasses a range of technologies, including machine learning, natural language processing, computer vision, and robotics, which enable businesses to process vast amounts of data, detect patterns, and make predictive decisions without human intervention (Attaran et al., 2020). AI has found applications across a variety of business functions, from customer service to supply chain management. In customer service, AI-driven chatbots and virtual assistants offer businesses a way to engage customers 24/7, resolving inquiries with minimal human involvement. In marketing, AI algorithms analyze consumer behavior and preferences, enabling businesses to tailor personalized marketing campaigns and improve customer engagement. In the financial sector, AI is used for fraud detection, algorithmic trading, and risk management, providing real-time insights and reducing human error (Bai et al., 2020).

AI enhances business decision-making by leveraging data-driven insights. Machine learning models can predict customer behaviors, optimize resource allocation, and suggest actionable strategies to increase profitability. AI also improves forecasting accuracy, which is particularly beneficial for inventory management, production planning, and demand forecasting. AI's role in business decision-making has expanded from simple data analysis to strategic, high-level decision support (Attaran et al., 2020). Despite its numerous benefits, the adoption of AI in business faces challenges such as data privacy concerns, high implementation costs, and the need for skilled personnel. Additionally, businesses must contend with ethical issues, such as bias in AI models and the potential for AI to replace human jobs, raising concerns about its impact on the workforce (Babich et al., 2019). Blockchain is a decentralized digital ledger that records transactions across many computers in a secure, transparent, and immutable way. Originally popularized by cryptocurrencies like Bitcoin, blockchain technology is now being explored for its potential in various industries, including finance, supply chain, healthcare, and logistics (Ahmad et al., 2019; Bai et al., 2020).

Furthermore, the Blockchain and MIS offer several key advantages to businesses, including enhanced security, transparency, and traceability. In supply chain management, blockchain can track products from production to delivery, ensuring authenticity and reducing fraud. In finance, blockchain enables secure, real-time transactions without the need for intermediaries, cutting down costs and processing time. Smart contracts, which are self-executing contracts with the terms of the agreement directly written into code, allow businesses to automate transactions and enforce contractual obligations without human intervention (Attaran et al., 2020). MIS and Blockchain's immutability and decentralized nature make it ideal for secure transactions. Unlike traditional centralized databases, blockchain ensures that once data is recorded, it cannot be altered or tampered with, providing a high level of security for sensitive business information. For businesses, this feature is particularly beneficial for securing payment systems, digital identities, and intellectual

property (Bai et al., 2020). Despite its promising applications, blockchain adoption in business faces challenges, including scalability issues, high energy consumption, and a lack of regulatory clarity. Additionally, businesses must overcome the complexity of integrating blockchain with existing systems and ensure that the technology is used in a way that complies with legal and regulatory requirements.

While both AI and blockchain have been individually explored in the business literature, research on their integration remains limited. However, recent studies have begun to highlight the potential benefits of combining AI and blockchain to address complex business challenges. For instance, some researchers suggest that AI can improve the scalability and performance of blockchain networks by optimizing consensus mechanisms and reducing energy consumption. Conversely, blockchain can enhance the transparency and trustworthiness of AI systems, ensuring that AI models are secure, auditable, and transparent. A number of studies have explored the integration of AI and blockchain in specific industries. In healthcare, for example, AI-powered blockchain solutions have been proposed to improve patient data management, ensuring that healthcare providers have access to secure and verified data. In supply chain management, AI and blockchain integration can enable real-time tracking of products, improve predictive maintenance, and streamline logistics operations.

3. Research Methodology

3.1. Bibliometric Analysis

Bibliometric analysis is a quantitative method used to analyze academic publications, providing insights into the intellectual structure of a field by identifying key authors, articles, and trends. In this study, bibliometric analysis is used to examine the body of literature related to AI and blockchain integration in business (Barua et al., 2004).

3.2. Data Collection and Analysis Tools

The data for the bibliometric analysis is collected from leading academic databases such as Scopus, Web of Science, and Google Scholar. The search terms include combinations of keywords like "Artificial Intelligence," "Blockchain," "Business," and "Integration." The time range for the literature search spans from 2010 to the present, focusing on peer-reviewed journal articles, conference papers, and industry reports. We use bibliometric analysis tools such as VOS viewer and Bibliometric to generate network maps of authors, journals, and keywords. These tools help identify the most frequently cited papers, the key research clusters, and the relationships between different topics within the literature (Choi et al., 2020).

3.3. Framework and Content Analysis

Content analysis is used to qualitatively examine the selected papers and extract key themes, patterns, and insights related to the integration of AI and blockchain in business (Barua et al., 2004). The content analysis framework follows a thematic analysis approach, where key themes are identified through coding and categorization. These themes are based on the common topics and issues raised in the literature, such as applications, benefits, challenges, and opportunities (Choi et al., 2020).

3.4. Thematic Coding and Integration

The coding process involves reading through the selected articles and identifying relevant sections related to the synergy between AI and blockchain in business. Each section is categorized under predefined themes, and new themes are added as they emerge from the literature. The results of the bibliometric analysis provide a quantitative overview of the field, while the content analysis adds depth by offering qualitative insights. By combining these two methods, we provide a comprehensive understanding of the current state of AI-blockchain integration in business (Fernández-Caramés et al., 2018; Choi et al., 2020).

4. Results and Discussion

4.1. Contribution of Artificial Intelligence, Blockchain, and MIS

This pie chart presents an illustration of the relative contributions that Artificial Intelligence (AI), Blockchain, and Management Information Systems (MIS) have made to the transformation of businesses. It is important to note that artificial intelligence (AI) plays a crucial role in predicting analytics, automation, and improving operational efficiency. It accounts for the highest proportion, providing fifty percent. With a contribution of thirty percent, blockchain comes in second, emphasizing the significance of its role in ensuring the safety of data management, promoting transparency,

and enhancing confidence in corporate procedures. Considering its foundational role in the organizing, processing, and management of organizational information for the purpose of informed decision-making, management information systems (MIS) contribute the remaining twenty percent (Figure 1).

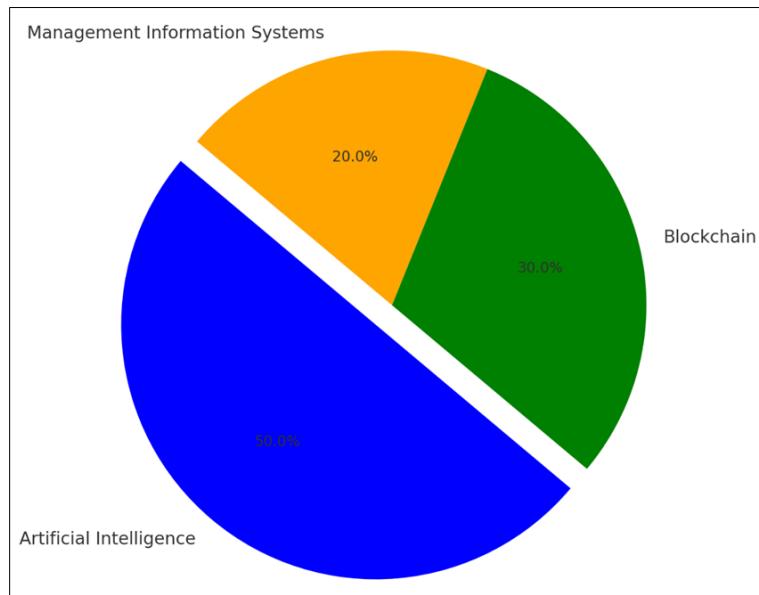


Figure 1 Contribution of Artificial Intelligence, Blockchain, and Management Information Systems to Business Transformation

In the graphic, the synergy between these technologies is highlighted. Artificial intelligence is responsible for sophisticated analytics, blockchain technology ensures the integrity and security of data, and management information systems serve as the foundation for data organization and accessibility. Through the enhancement of efficiency, the facilitation of new solutions, and the provision of support for strategic decision-making, these technologies, when combined, produce a robust framework through which business transformation can be accomplished. This image does an excellent job of illustrating the proportional roles that these technologies play in the process of updating and changing enterprises.

4.2. Management Information Systems in Business Transformation

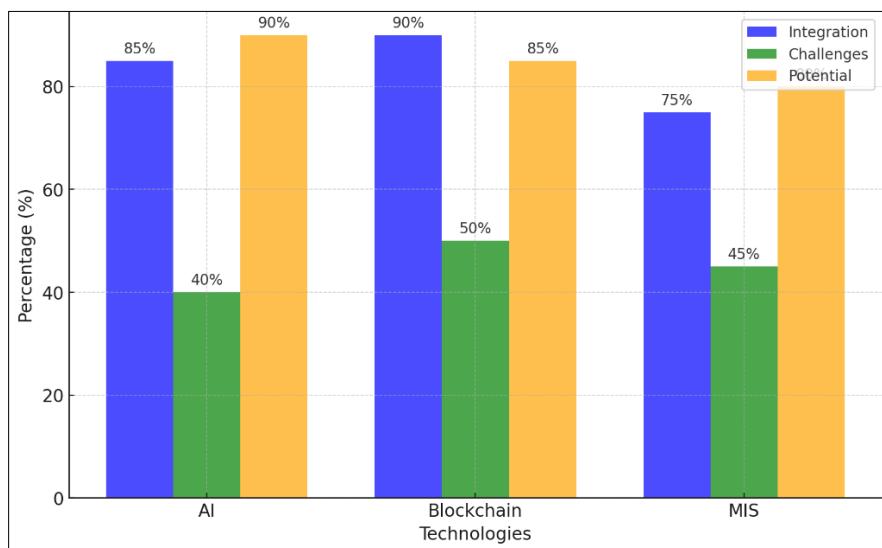


Figure 2 Comparison of Integration Levels, Challenges, and Potential of Artificial Intelligence, Blockchain, and Management Information Systems in Business Transformation

The integration levels, problems, and promise of Artificial Intelligence (AI), Blockchain, and Management Information Systems (MIS) in driving business transformation are compared in this grouped bar chart. Integration levels are represented by the blue bars, which show that artificial intelligence is highly integrated (85%), blockchain is somewhat higher (90%), and management information systems are moderately integrated (75%). This reflects the established role that artificial intelligence plays in predictive analytics and automation, the growing usage of blockchain technology for safe data management and transparency, and the foundational function that management information systems play in data organization and decision-making support. All of the difficulties that are linked with each technology are represented by the green bars. Scalability, regulatory ambiguity, and energy-intensive operations are some of the most major obstacles that blockchain technology faces, accounting for fifty percent of all the challenges. Given that it is dependent on the correct implementation and the incorporation of other sophisticated technologies, management information systems (MIS) come in at 45%. The least number of obstacles are associated with artificial intelligence (40%) yet it is still necessary to address concerns such as ethical use, bias, and high implementation costs (Figure 2).

The orange bars illustrate the possibility that these technologies will bring about a transformation in businesses. Artificial intelligence (AI) and blockchain technology both have enormous promise, as evidenced by their respective scores of 90% and 85%, which indicate that they have the potential to change decision-making, security, and operational efficiency. Its important importance in providing a continuous flow of information and supporting innovative technologies is highlighted by the fact that MIS accounts for 80 percent of the total. This figure highlights the synergy between artificial intelligence (AI), blockchain technology, and management information systems (MIS), while also demonstrating the distinct advantages, challenges, and revolutionary capabilities of each of these technologies. In conjunction with one another, they constitute a solid basis for the modernization of corporate procedures, the facilitation of innovation, and the promotion of sustainable growth.

The integration of Artificial Intelligence (AI) and Blockchain technology has gained significant attention in recent years, and the literature review indicates that several key trends have emerged across various industries. These trends reflect how businesses are leveraging the strengths of both technologies to address complex challenges and drive innovation. One of the most prominent trends identified in the literature is the use of AI and blockchain in enhancing supply chain operations. Blockchain's immutable and transparent nature allows businesses to track goods from production to delivery, ensuring the authenticity of products and reducing fraud. AI, on the other hand, optimizes processes like inventory management, predictive maintenance, and demand forecasting. Together, these technologies offer a powerful solution for streamlining supply chains, improving efficiency, and reducing costs.

Several case studies highlight the successful implementation of AI-blockchain solutions in supply chain management. For instance, companies in the food industry have used AI to predict demand and optimize inventory levels while using blockchain to ensure traceability and prevent counterfeit products from entering the market. These efforts have not only increased operational efficiency but have also enhanced consumer trust in the products.

5. Challenges and Future Directions

Businesses must navigate the legal complexities of AI-blockchain integration, ensuring compliance with data privacy laws, intellectual property rights, and industry-specific regulations.

Adopting AI-blockchain solutions requires significant organizational changes. Companies must invest in training their workforce to understand and use these new technologies (Karl et al., 2019; Chang et al., 2019). This can be a barrier, especially for small and medium-sized businesses that may not have the resources to upskill their employees or hire specialized talent. Furthermore, businesses need to ensure that their existing systems can integrate with AI and blockchain platforms. Legacy systems, which are often outdated and incompatible with newer technologies, can hinder the smooth integration of AI and blockchain, resulting in additional costs and delays (Fernández-Caramés et al., 2018). Despite these challenges, the potential benefits of AI-blockchain integration far outweigh the obstacles. The combination of AI's predictive capabilities and blockchain's secure, transparent infrastructure can create new opportunities for businesses to innovate, streamline operations, and enhance decision-making (Stafford et al., 2020). AI and blockchain can significantly enhance operational efficiency by automating tasks, reducing fraud, and streamlining workflows. In industries like supply chain management, where visibility and traceability are critical, the integration of AI and blockchain can reduce delays, optimize inventory, and ensure that all stakeholders have real-time access to accurate information (Manupati et al., 2020; Tandon et al., 2021).

However, the integration of Artificial Intelligence (AI), Blockchain, and Management Information Systems (MIS) comes with considerable problems that demand strategic attention. This integration has enormous promise for altering corporate processes, but it also comes with risks that must be considered (Tian et al., 2016). Interoperability, in which

seamless communication between various systems and technologies continues to be a challenge, and scalability, in which businesses struggle to efficiently apply these solutions across big and complicated networks, are two of the most important difficulties (Nurgazina et al., 2021). Further investigation and responsible innovation are required because of the ethical considerations that surround data privacy, algorithmic prejudice, and the environmental impact of Blockchain's operations, which need a significant amount of energy. To solve the issues of interoperability and scalability, future directions for research and practice include the development of standardized protocols and frameworks (Queiroz et al., 2019; Choi et al., 2020). It is necessary for academics, technology developers, and legislators to work together to produce comprehensive regulatory rules that guarantee the application and utilization of ethical practices. In addition, the development of artificial intelligence and blockchain technologies, with a particular emphasis on energy efficiency and inclusivity, will be essential in encouraging the adoption of sustainable practices (Ramos-Rodríguez et al., 2004). It is possible that additional research might investigate the possibility of incorporating these technologies into specialized fields, such as agriculture, healthcare, and education, to realize their full potential (Scott Miao et al., 2018; Batagelj et al., 2004). The utilization of these technologies to improve decision-making, encourage transparency, and promote resilience in business environments that are prone to volatility should also be emphasized. The confluence of artificial intelligence, blockchain technology, and management information systems can be harnessed by enterprises to generate transformative and sustained commercial success if they handle these obstacles.

6. Recommendation

Another growing trend is the use of AI and blockchain in the financial sector to enhance security, transparency, and transaction efficiency. Blockchain and MIS decentralized nature makes it an ideal platform for secure financial transactions, enabling real-time, peer-to-peer transfers without the need for intermediaries. AI further strengthens this integration by enabling fraud detection, risk management, and the automation of trading and financial decision-making. In the banking sector, AI-driven blockchain solutions have been used to detect unusual transaction patterns and predict potential fraud, thereby reducing the risk of financial crimes. Blockchain also helps streamline regulatory compliance processes, as it offers a transparent and immutable record of transactions that can be audited in real time. Blockchain technology is also being used to address transparency and accountability issues in AI systems. AI models, especially those based on deep learning algorithms, are often seen as "black boxes," making it difficult to understand how they arrive at certain decisions. By integrating blockchain and MIS, businesses can ensure that the decision-making process of AI systems is traceable, auditable, and transparent, which is particularly important in regulated industries like healthcare and finance. For example, AI models used in healthcare for diagnosis or drug discovery can benefit from blockchain's transparency, allowing healthcare providers and patients to trace the origins and logic of AI-driven decisions. This not only improves trust in AI systems but also mitigates risks related to biased or incorrect decision-making. Several technological advancements are enabling the effective integration of AI and blockchain in business applications. These innovations are improving the scalability, security, and functionality of both technologies, making them more feasible for widespread business adoption.

Smart contracts, which are self-executing contracts with the terms of the agreement directly written into code, are a significant innovation that facilitates the integration of AI and blockchain. These contracts can automatically execute and enforce contractual terms based on predefined conditions. When combined with AI, smart contracts can be used to automate complex business processes and decision-making workflows. For instance, in supply chain management, AI can be used to predict when goods will be delivered, and a smart contract can automatically trigger the next action, such as payment or further processing, once the goods arrive. This automation reduces the need for human intervention and increases the efficiency of operations. Decentralized AI models are another innovation that benefits from blockchain's capabilities. Traditional AI models rely on centralized data repositories and processing power, which can create privacy and security concerns. Decentralized AI, in contrast, uses blockchain to store data and distribute processing tasks across a network of nodes. This approach not only enhances data security but also allows for more equitable access to AI models and their benefits.

7. Conclusion

The integration of Artificial Intelligence (AI) and Blockchain technologies offers immense potential to transform various business sectors by combining AI's ability to analyze vast datasets and make predictive decisions with Blockchain's decentralized, secure, and transparent nature. Our bibliometric-content analysis highlights the growing synergy between these two technologies, revealing significant trends and opportunities that businesses can leverage to drive innovation and operational efficiency. The combination of Artificial Intelligence (AI), Blockchain, and Management Information Systems (MIS) represents a revolutionary step forward in terms of the creativity and operational excellence of businesses. The results of this bibliometric-content analysis have shown that the synergy between these technologies

is responsible for driving organizational efficiency, improving decision-making, and fostering a competitive edge in markets that are always changing. Artificial intelligence's capabilities in predictive analytics and automation, in conjunction with Blockchain's capacity to protect and decentralize data, combine the structured information management capabilities of management information systems (MIS) to produce a robust framework for modern businesses. Several notable breakthroughs have been made in areas such as the modeling of customer behavior, the transparency of supply chains, and the security of financial transactions, as highlighted by the report. Nevertheless, it also highlights persisting problems, such as interoperability, scalability, and ethical considerations, which call for concerted efforts by researchers, regulators, and industry leaders working together. Because of the growing adoption of these technologies by businesses, it is becoming increasingly important to have well defined regulatory frameworks and to conduct research that draws from other disciplines to successfully address these obstacles. As a result of exposing the potential and drawbacks of this integration, this study offers useful insights to both academics and practitioners, thereby paving the way for novel corporate strategies. The future of business transformation will be marked by a paradigm shift if businesses are able to uncover new prospects for sustainable growth, resilience, and flexibility through the promotion of collaboration between strategic management and technical development.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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