



Blockchain Technology: Transforming Accounting, Marketing, and Supply Chain Management

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ABSTRACT

This study explores the transformative potential of blockchain technology across diverse business domains, focusing on accounting, marketing, and supply chain management. Blockchain's decentralized ledger system offers enhanced transparency, security, and efficiency, revolutionizing traditional practices. Through a comprehensive review of literature and case studies, this research examines how blockchain can improve financial record-keeping, data management in marketing, and traceability in supply chains. By leveraging blockchain's capabilities, organizations can streamline operations, reduce fraud, and enhance trustworthiness, ultimately paving the way for more resilient and innovative business practices.

Keywords: Blockchain technology, accounting, marketing, supply chain management, transparency

1. Introduction

Blockchain is emerging as a groundbreaking technology, influencing paradigms like the Internet of Things, iCollaboration, artificial intelligence, technostress, and the darker aspects of digital innovations. It has created significant excitement across various industries by promising enhanced business processes and building trust. Particularly, the financial sector perceives blockchain as a disruptive force that must be managed and adapted (Nowiński & Kozma, 2017). Blockchain operates as a decentralized transaction and data management system, enabling community users to validate, maintain, and synchronize a transaction ledger replicated across multiple nodes. This technology gained widespread attention in 2008 when an anonymous figure (or group) under the pseudonym Satoshi Nakamoto published a white paper introducing Bitcoin, a digital currency application utilizing blockchain technology (Yli-Huumo et al., 2016; Aste et al., 2017).

This study aims to explore the numerous applications of blockchain technology in various business domains, particularly in accounting, marketing, and supply chain management. By examining previous literature, I will analyze how blockchain can enhance transparency, security, and efficiency in these fields. In accounting, blockchain's immutable ledgers promise to revolutionize financial record-keeping by providing a tamper-proof method for tracking transactions, thereby reducing fraud and errors. In marketing, blockchain can ensure data integrity, enhance customer trust, and facilitate more secure and transparent interactions between businesses and consumers. These aspects are deemed to be crucial in contemporary business entities as there are always the risks of fraudulent activities by involving the fraud factors (Chakraborty et al., 2017), or using up the excess amount of free cash flows can facilitate earnings management as well (Saha et al., 2016). Specifically for supply chain management, blockchain enables real-time tracking of goods, reduces the risk of fraud, and ensures authenticity and provenance of products throughout the supply chain. This comprehensive study will provide valuable insights into how blockchain technology can drive innovation and improve business processes, ultimately contributing to more efficient and trustworthy business operations.

This study will highlight how blockchain technology can significantly enhance transparency in accounting practices. By leveraging blockchain's immutable and distributed ledger system, organizations can ensure that all financial transactions are accurately recorded and cannot be altered or deleted. This reduces the risk of fraud and errors, providing a clear and auditable trail of financial activities. The study will explore various case studies and previous research demonstrating the effectiveness of blockchain in improving the reliability and integrity of financial reporting, ultimately fostering greater trust among stakeholders, including investors, regulators, and auditors.

Another key contribution of this study is examining how blockchain can improve trust and efficiency in marketing. By providing a secure and transparent platform for data exchange, blockchain ensures that marketing data, such as customer information and transaction records, is authentic and tamper-proof. This can enhance consumer trust, as customers are assured of the privacy and accuracy of their data. The study will delve into specific blockchain applications in marketing, such as loyalty programs, digital advertising, and customer relationship management, showcasing how blockchain can streamline marketing operations and lead to more effective and trustworthy customer interactions.

The study will also contribute to understanding how blockchain can revolutionize supply chain management through real-time traceability. Blockchain technology allows for the continuous and transparent tracking of products from origin to end consumer. This not only ensures the authenticity and quality of products but also enhances the efficiency of supply chain operations by reducing delays and errors. By exploring various case studies and existing literature, the study will demonstrate how blockchain can address common supply chain challenges, such as counterfeit goods, inefficient processes, and lack of transparency, leading to more resilient and reliable supply chains.

2. Blockchain at a glance

Blockchain serves as a digital, decentralized ledger designed to record every data transaction occurring within its network. Each user functions as a network node and retains a copy of the ledger. Transactions within the blockchain database undergo verification by participating users, eliminating the need for a trusted third-party verification (Konstantinidis et al., 2018). Blockchain is a technology and methodology that empowers community users to validate, maintain, and synchronize the contents of a transaction ledger, which is replicated across numerous users. Essentially, Blockchain serves as a decentralized transaction and data management technology. Its prominence grew in 2008 with the emergence of Bitcoin, a digital currency application introduced through a white paper authored by an anonymous individual or group (Yli-Huumo et al., 2016; Aboujaoude & Saade, 2019).

The concept of Blockchain, as defined by the Oxford dictionary, typically pertains to a system primarily utilized for recording transactions in cryptocurrencies like Bitcoin. However, its potential applications extend far beyond cryptocurrency, prompting a broader interpretation. Researchers propose an expanded definition of Blockchain as a technological framework facilitating the immutability and integrity of data. It operates by storing transaction records across multiple distributed nodes interconnected in a peer-to-peer network. This broader definition encompasses various inherent properties of blockchain technology. For instance, the level of transparency can be adjusted based on the extent of information publicly disclosed, enhancing auditability. Additionally, the decentralized nature of blockchain enhances resilience, with the system's robustness increasing as more nodes participate. However, the correctness of the system relies on the assumption of trustworthiness among the majority of nodes. Through establishing trust in data, blockchain obviates the need for centralized intermediaries. (Viriyasitavat & Hoonsopon, 2019).

In business context, the origins of blockchain trace back to a white paper authored (Nakamoto, 2008). Nakamoto proposed a peer-to-peer electronic cash system called bitcoin, enabling direct online payments between parties without the need for centralized financial intermediaries (Saha et al., 2024). Alongside bitcoin, Nakamoto conceptualized the ledger, referred to as "a chain of blocks," to support this digital currency. This innovation ultimately became known as blockchain. Since Nakamoto's initial introduction of blockchain, numerous other blockchain technologies have been developed, marking significant advancements in the field.

Blockchain technologies have the potential to disrupt traditional business models and create entirely new opportunities. Organizations operating as intermediaries between transaction parties must assess how blockchain might impact their value propositions, competitiveness, and operations. Pilot projects across various industries, such as tracking goods in supply chains, facilitating real estate transactions with smart contracts, and enabling low-cost international fund transfers, demonstrate the diverse applications of blockchain. Businesses need to evaluate how these advancements may affect their existing models. To facilitate this discussion, some researchers adopt the business model framework proposed by Osterwalder and Pigneur (2013), which describes how organizations create, deliver, and capture value through nine building blocks. These blocks cover customer segments, value proposition, channels, customer relationships, revenue streams, key resources, key activities, key partnerships, and cost structure.

3. Blockchain application in accounting and audit domain

Digitalization is everywhere, even in national level decision makers influenced by digital technologies (Hong & Bhuiyan, 2023). Accounting and auditing developed organically as means to establish mutual trust and safeguard investors. Contemporary accounting has its roots in 13th-century Italian commercial activities. To enhance the precision of accounting records, merchants created the double-entry bookkeeping system. This method gained widespread acceptance after Luca Pacioli detailed it in his mathematics textbook published in Venice in 1494 (Waymire & Basu, 2008). To ensure the integrity of financial statements and disclosures, the independent external auditing system emerged (Watts & Zimmerman, 1983). By conducting audits, auditors could detect fraud and errors in financial statements, thereby mitigating the opportunistic behaviors of insiders. Consequently, the external auditing system helps reduce information asymmetry between a firm's insiders and external information users, enhancing the firm's value (Jensen & Meckling, 1976; Watts & Zimmerman, 1983).

Al Kemyani et al. (2022) conducted a thematic analysis to contribute to the existing literature. Their study revealed through a survey that this technology is relatively new in Oman. The government can play a crucial role by incorporating this technology into finance-related educational programs and by organizing seminars and workshops for professionals in the financial industry. According to Dai and Vasarhelyi (2017), since 2009, blockchain has emerged as a potentially transformative information technology, anticipated to be as revolutionary as the Internet. Initially created to record cryptocurrency transactions, blockchain has expanded to numerous applications, including banking, financial markets, insurance, voting systems, leasing contracts, and government services. Despite these advancements, the application of blockchain in accounting and assurance remains largely unexplored. Previous research papers seek to initiate a discussion on how blockchain could create a real-time, verifiable, and transparent accounting ecosystem. Furthermore, blockchain has the potential to revolutionize current auditing practices, leading to a more precise and timely automatic assurance system.

3.1 Accounting

This section examines how blockchain can enable smart accounting through the use of smart contracts to create a digitalized accounting ecosystem. Smart contracts are the core technology driving smart accounting (Desplebin et al., 2021). Smart contracts are "intelligent" computer programs that leverage blockchain technology. They are considered intelligent because they can operate autonomously, including verifying the conditions of their execution and self-activating when necessary (Abdul, 2024; Hileman and Rauchs, 2017). In essence, "smart contracts digitally facilitate, verify, control, and enforce transactions" (Schmitz and Leoni, 2019: 336). The recent advancements in this technology have allowed for the decentralization and securing of smart contracts, a feat previously unattainable, making their application in the professional sector feasible.

The triple accounting system enhances traditional accounting by adding a blockchain-based third entry, ensuring greater transparency, security, real-time auditing, and compliance in financial reporting (Pascual Pedreño et al. 2021). The application of blockchain technology in a triple accounting system marks a transformative advancement in accounting practices. Traditional double-entry accounting, which records transactions in two accounts, is enhanced by adding a third entry on the blockchain—a cryptographic proof of the transaction securely and transparently recorded on a distributed ledger. This integration offers enhanced transparency, as every transaction is accessible to all relevant parties, reducing the potential for fraud and errors. As the generation and dissemination of financial information is at the focus of accounting, utilization of blockchain comes relevant in many aspects. The ownership of shares in the firms by the institutional or foreign investors, or the familial connection of the top leaders in the boards might impact the firm performance (Ali et al., 2023; Mazumder et al., 2024). Blockchain can efficiently process that information and help the management and the shareholders to use the understanding to their advantage. Better depiction of voluntary disclosures like the ration related information always holds an important place in the financial reporting (Uddin & Mazumder, 2016), and blockchain can be used in such cases as well.

Blockchain's immutability ensures that once a transaction is recorded, it cannot be altered or deleted, safeguarding financial records' integrity. Furthermore, real-time auditing becomes possible, improving efficiency and accuracy while reducing costs. By providing all stakeholders with the same verifiable information, blockchain reduces information asymmetry between management and external parties like investors and regulators. Additionally, smart contracts can automatically enforce compliance with accounting standards, ensuring adherence to financial reporting frameworks. Overall, incorporating blockchain into a triple accounting system promises to revolutionize accounting by making financial reporting more reliable, transparent, and efficient.

3.2 Audit

Given the disruptive impact of blockchain and other emerging technologies on the profession, the American Institute of Certified Public Accountants (AICPA) has been monitoring legislative agendas to assess potential influences on CPA firms (AICPA, 2018).

Additionally, the AICPA has launched a Blockchain learning program to help practitioners understand the technology and explore its practical applications. The Big Four accounting firms have also been researching and investing in blockchain. In August 2016, they met with the AICPA to explore blockchain solutions for the accounting industry, potentially leading to a distributed ledger consortium (Kokina et al., 2017). PwC is advising Cred on issuing a United States dollar-pegged cryptocurrency.

Indeed, blockchain is often likened to automation and data analytics, signaling a shift in how audits are conducted (Raphae, 2017). This technology has the potential to not only prompt changes in accounting and auditing regulations but also to redefine the essence of the accounting and auditing profession. Executives emphasize blockchain's superiority as a ledger, enabling the addition of entries and facilitating cross-verification among multiple ledgers (Martindale, 2016). Furthermore, it introduces a third validation point previously absent, potentially reducing the need for auditors' intervention in the future (Brender et al., 2018). Moreover, blockchain could streamline audit and control processes by embedding rules directly into specific operations. However, a significant challenge lies in the potential restructuring of audit and control activities to align with blockchain's properties, such as transparency, traceability, security, and the immutability of transactions.

Li (2017) highlighted, blockchain ensures that every transaction is recorded, encrypted, and immutable, thereby eliminating the possibility of falsification. This characteristic simplifies the acquisition of audit evidence at the assertion level, reducing detection risk and mitigating the impact of asymmetric information. The encryption of blockchain also enhances resistance to malicious attacks, maintaining the accuracy of accounting records and minimizing the risk of data loss across all nodes. Furthermore, because transaction data is stored in every node, auditing processes are not constrained by geographical limitations. The non-modifiability of blockchain prevents financial statement fraud, aligning well with the audit function. In various sectors including Fintech, Consulting, and Audit, blockchain is increasingly utilized. For instance, Deloitte has introduced Rubix, an application platform offering services such as counterparty confirmation and real-time auditing. According to Deloitte's Chief Advisory Officer, the transparency and timestamp features of blockchain accelerate auditing processes by providing auditors with easy access to all client transactions.

Accounting	Audit
Blockchain enables smart accounting through smart contracts, automating transaction verification and execution.	AICPA monitors legislative agendas and explores potential influences on CPA firms.
Triple accounting integrates blockchain for enhanced transparency, security, and compliance, ensuring real-time auditing.	The AICPA launches Blockchain learning programs to educate practitioners on the technology.

Blockchain's immutability safeguards financial records, preventing tampering or fraud, and ensuring the integrity of transactions.	The Big Four accounting firms invest in blockchain research and explore its applications in auditing.
Smart contracts enforce compliance with accounting standards, ensuring adherence to financial reporting frameworks and reducing errors.	Blockchain's transparency simplifies audit evidence gathering, reducing detection risk and enhancing accuracy.
Blockchain technology provides a decentralized ledger system, reducing the risk of data loss and ensuring the availability of transaction records.	Executives recognize blockchain's potential to revolutionize auditing practices, enhancing efficiency and effectiveness.
Real-time auditing becomes feasible with blockchain, enabling auditors to access transaction records instantly and ensuring timely assessments.	Blockchain's encryption and decentralization enhance security, resisting malicious attacks and maintaining the accuracy of accounting records.
Incorporating blockchain into accounting systems minimizes information asymmetry between stakeholders, providing equal access to transaction data.	Blockchain's timestamp feature facilitates audit trails, allowing auditors to track transaction history and verify the integrity of financial records.
Blockchain's automated verification and execution processes reduce the need for manual intervention, streamlining accounting operations and reducing errors.	Deloitte's Rubix platform exemplifies blockchain's application in auditing, offering services such as counterparty confirmation and real-time auditing.

4. Blockchain application in marketing

While the introduction of blockchain appears poised to disrupt marketing operations and interactions with consumers and stakeholders, there remains a notable gap in research on the subject. Blockchain application in marketing will likely lead to disintermediation, heightened trust between firms and consumers, improved transparency, enhanced auditability and accountability, and the establishment of novel relationships with consumers and suppliers via tokenization and smart contracts. Several applications have the potential to significantly transform marketing, including indirect ones like supply chain management and digital payments using cryptocurrencies, as well as direct ones such as credential management, digital marketing, and loyalty programs (Antoniadis et al. 2019).

4.1 Customer relationship and trust

One of the most evident applications of blockchain technology is in digital payments. Cryptocurrencies enable transactions with both customers (B2C) and suppliers (B2B), utilizing smart contracts to ensure transaction speed and security, thereby fostering trust between participating parties (Pilkington, 2016). Additionally, the elimination of intermediaries reduces operational and financial costs, thereby increasing profit margins for each transaction (Gupta, 2017). Furthermore, the public's attention and curiosity towards bitcoin and other cryptocurrencies can be leveraged for marketing purposes to attract more customers, as demonstrated by Malta's efforts to enhance its image as a tourism destination (Antoniadis et al., 2019).

Loyalty schemes and programs can undergo a significant transformation through the integration of tokens and blockchain technology, facilitated by smartphone apps (Mire, 2018). Tokenization offers the advantage of consolidating all loyalty schemes, including gift cards, into a single platform. This platform can not only track purchases but also encompass a consumer's overall engagement with the brand or retailer, integrating digital marketing and social networking sites (Campbell et al., 2018). Tokenization enables a more comprehensive loyalty program experience where all customer interactions with the brand are considered, including purchases, reviews, and social media interactions, in a transparent and easily monitored manner. Several companies, such as Cathay Pacific and Air Asia, have already leveraged blockchain for this purpose, transforming their air miles benefit schemes through blockchain and mobile devices. By combining blockchain with gamification, these companies offer an improved customer experience. The blockchain platform automates data fulfillment procedures, ensuring a transparent transaction history between the airline and participating partners, enhancing business efficiency, and minimizing back-office administration (O'Leary, 2018).

4.2 Advertising

In the realm of advertising, the internet has emerged as a powerful communication platform, facilitating connections between brands and potential customers. Over the past few years, various ecosystems have evolved to serve this purpose (Alaimo & Kallinikos, 2018). The introduction of cookies allowed user logs to be stored via browsers, enabling targeted digital marketing (Durach et al. 2021). However, Google's announcement to phase out support for cookies on Google Chrome has sparked concerns among advertisers and publishers, prompting a search for alternative solutions to preserve online advertising. Companies operating in this domain focus on addressing Blockchain Technology (BCT) application areas such as paying for performance, paying for attention, or managing performance systems transparently (Gusic & Stallone, 2020).

Blockchain-based advertising platforms offer consumers the assurance of privacy by providing them with complete control over their data within the system. While privacy through blockchain does not entail complete concealment of consumer data, it allows consumers to dictate how their data is shared within the system. This empowers consumer-centered advertising, the cornerstone of intelligent advertising, to be implemented more effectively. For advertisers, intermediaries, and publishers, blockchain-based advertising ensures the data-driven nature of intelligent advertising through the transparency of data stored in the blockchain. With data transparency and a privacy-ensured ad delivery process, the algorithmic-mediated aspect of intelligent advertising becomes fully functional and highly reliable (Kim et al., 2023).

4.3 Ecommerce

Blockchain technology (BCT) offers several advantages for ecommerce platforms, including an efficient payment system, decentralized control to prevent the dominance of large companies, an anti-fraud system, reduced transaction processing charges, and overall improved efficiency (Bulsara & Vaghela, 2020). The integration of Blockchain technology into consumer-to-consumer (C2C) trade represents a significant advancement in e-commerce, fostering an environment of trust and credibility in trade transactions. By tracking and distributing consumer records and enabling transparent progress tracking of business transactions, Blockchain enhances transparency and accountability. The smart contracts are employed to facilitate various business processes between consumers, including buying, selling, transferring goods, providing feedback, and evaluation. Blockchain's revolutionary potential is seen as a viable alternative to traditional processes, empowering small traders to conduct operations without intermediary interventions. By combining the C2C model with Blockchain technology, the proposed model aims to create an effective trading environment, mitigating concerns among consumers and enhancing trust and credibility. Through the ability to track records and assess consumer feedback, the model instills confidence in consumers, empowering them to make informed decisions when interacting with others. This approach is expected to increase C2C trade activities and explore alternative payment methods such as installment payments or barter, driven by the confidence generated by the proposed model (Shorman et al. 2019).

Customer Relationship and Trust	Advertising	Ecommerce
- Blockchain enables digital payments, fostering trust between customers and suppliers through smart contracts.	- Internet serves as a powerful advertising platform, but Google's phase-out of cookie support prompts concerns.	- Blockchain offers an efficient payment system, anti-fraud measures, and reduced transaction costs for ecommerce platforms.
- Elimination of intermediaries in blockchain transactions reduces operational costs and increases profit margins.	- Blockchain-based advertising platforms ensure data transparency and privacy, enhancing intelligent advertising.	- Integration of blockchain into C2C trade enhances trust and credibility, empowering small traders to operate without intermediaries.
- Public's interest in cryptocurrencies can be leveraged for marketing purposes, as seen in Malta's tourism efforts.	- Blockchain technology addresses BCT application areas such as paying for performance and managing performance systems transparently.	- Smart contracts in blockchain facilitate various business processes in C2C trade, including buying, selling, and providing feedback.
- Tokenization transforms loyalty schemes, integrating purchases, reviews, and social media interactions transparently.	- Blockchain-based advertising platforms offer privacy assurance to consumers, allowing them to control their data within the system.	- Blockchain's transparency and accountability enhance trust in trade transactions, leading to increased C2C trade activities.
- Companies like Cathay Pacific and Air Asia leverage blockchain for loyalty schemes, enhancing customer experience.	- Blockchain technology ensures the data-driven nature of intelligent advertising, making ad delivery more reliable.	- Expected increase in C2C trade activities and exploration of alternative payment methods like installment payments or barter, driven by blockchain's ability to instill confidence and empower informed decision-making among consumers (Shorman et al., 2019).

5. Blockchain application in supply chain

While still in its nascent stage, blockchain technologies are steadily gaining traction in supply chain operations. Wang et al. (2019) assert that these technologies notably enhance SCM activities in areas such as extended visibility and traceability, digitalization, supply chain integration, improved data security, and smart contracts. Furthermore, the adoption of an advanced solution like blockchain in supply chain management can mitigate opportunities for personal advantage-seeking by employees and enhance overall supply chain reliability. Many researchers suggest that employees may exploit existing loopholes or opportunities within business processes for fraudulent activities if circumstances permit (Bhuiyan et al., 2024). Moreover, such vulnerabilities in firm operations can potentially impair performance due to factors like internal conflicts of interest among employees or inefficient utilization of free cash flows for earnings management purposes.

5.1 Procurement

In the realm of procurement, blockchain technology is revolutionizing traditional processes and addressing critical challenges faced by businesses. One significant area of impact is in enhancing data exchange, where blockchain solutions ensure secure and transparent sharing of information across all procurement functions. This not only streamlines operations but also strengthens relationships with suppliers by providing a trusted platform for collaboration. Furthermore, blockchain's role in establishing product provenance is paramount, enabling end-to-end traceability throughout the supply chain (Bhuiyan et al., 2024). By leveraging blockchain, procurement departments can verify the authenticity and origin of products, thereby mitigating risks associated with counterfeit goods and ensuring compliance with regulatory standards. Moreover, blockchain enhances product and data security by employing cryptographic techniques to safeguard sensitive information. This reduces the likelihood of fraudulent activities and enhances trust among stakeholders. Additionally, blockchain contributes to cost efficiency in procurement by optimizing processes such as contract management and cost analysis. Moreover, the infrastructure and work process in the entities also affect the performance of the workforce and the overall entities (Bhowmik et al., 2017). Blockchain helps to analyze the impact and depict the crucial relationships in a better way. Through automation and smart contracts, organizations can achieve greater transparency and accuracy in financial transactions, ultimately driving down operational costs. Overall, the adoption of blockchain in procurement signifies a transformative shift towards more efficient, secure, and transparent supply chain management practices (Gürpınar 2020).

Sustainability is required in every business context (Saha et al. 2024). By leveraging its decentralized architecture and immutable recordkeeping capabilities, blockchain technology holds the potential to address longstanding challenges in ensuring transparency, traceability, and sustainability across supply chains. Some researchers explore the effectiveness, challenges, and future implications of blockchain in sustainable procurement. Through a comprehensive approach, the study examined how blockchain can revolutionize procurement processes. The decentralized ledgers and smart contracts inherent in blockchain offer unprecedented transparency, recording every transaction from raw material sourcing to product delivery. This transparency builds trust and accountability among stakeholders, essential elements of sustainable procurement. Additionally, integrating blockchain technology promises to automate and streamline procurement processes, ensuring consistent adherence to sustainability standards (Odułaja et al., 2023).

5.3 Logistics

Logistics plays a crucial role for organizations, consumers, and the economy, yet it also poses numerous challenges including delayed deliveries, lost documentation, errors, source of documentation, and lack of employee training. However, these obstacles can be mitigated and potentially eliminated through the implementation of blockchain technology. Blockchain offers numerous advantages including transparency, traceability, security, efficiency, reliability, and immutability. These features serve as effective solutions for addressing logistical challenges. Even simple applications of blockchain can yield significant benefits for companies in terms of improving processes and reducing costs within the logistics sector (da Silva et al., 2022).

Logistics encompasses managing a company's physical flows, involving activities like demand forecasting, sales planning, supply requirements, inventory management, and product distribution. The fourth industrial revolution and technological advancements have presented various challenges for logistics, accelerating the integration of technology into all processes. This evolution has given rise to the concept of 'smart logistics' or 'logistics 4.0'. Smart logistics, as described by McFarlane, involves planning and controlling using intelligent tools and methods (Issaoui et al. 2019). The level of intelligence in smart logistics depends on the applications and methods employed, spanning from product traceability and environmental element identification to problem detection, solution selection, and automatic execution (McFarlane et al. 2016).

Blockchain applications in logistics offer a significant advantage due to the inherent features of immutability, transparency, and decentralization. Kim and Laskowski (2018) as well as Crosby et al. (2016) emphasize the accessibility of critical data stored across multiple computers, creating a secure, duplicated, and synchronized ledger. For instance, digital bills of lading, which cannot be covertly altered, ensure visibility of the original document at all times. This facilitates faster processes and cost reduction by minimizing or eliminating paperwork associated with current business practices. Furthermore, the current logistics system often has limitations in tracing the origins of goods or gaining comprehensive knowledge about them. Blockchain provides a secure platform for stakeholders to share and exchange information about their goods and products. This enhanced transparency allows companies to demonstrate the safety and sustainability of their products to consumers, potentially increasing customer loyalty and profitability (Dobrovnik et al., 2018).

5.3 Production and manufacturing

Blockchain technology has the potential to enhance trust and efficiency in intelligent manufacturing, offering a novel value proposition (Yang, 2019). Previous study presents a model outlining the application of blockchain in intelligent manufacturing across four key levels: Industrial big data integration, networked collaborative manufacturing, full life-cycle management, and manufacturing model innovation. In industrial big data integration, blockchain enables secure data sharing, laying the groundwork for connectivity in intelligent manufacturing. For networked collaborative manufacturing, blockchain utilizes data integration to streamline distributed collaborative production processes. Full life-cycle management benefits from data integration and collaborative production, enabling comprehensive monitoring and effective supply chain management (Khan et al., 2024). Additionally, blockchain enhances transparency in manufacturing resources, facilitating innovation in manufacturing models (Zhang et al., 2019).

Moreover, some explore the implications of blockchain technology for the sustainability of manufacturing firms, highlighting benefits such as real-time transparency and cost savings. Blockchain ensures the integrity of distributed systems while enabling transparency and cost reduction through consensus

algorithms. Its application spans various industries, including finance, where it aims to decrease surveillance costs and remittance fees. In manufacturing, blockchain is poised to reform supply chains, reducing verification and surveillance costs and enhancing product quality, particularly in sectors like composite materials and agri-food. Adoption of blockchain is expected to lower networking costs for manufacturing firms and foster network effects through new market platforms. Comparative analysis indicates that manufacturing firms can boost profits through blockchain's real-time transparency and cost-saving features, potentially surpassing competitors. Thus, effective adoption of blockchain technology is recommended to support sustainability in the manufacturing industry (Ko et al., 2018).

Procurement	Logistics	Production
Blockchain technology transforms conventional procurement processes, ensuring secure and transparent data exchange while fostering collaboration with suppliers.	Blockchain addresses logistical hurdles by providing transparency, traceability, security, and efficiency in managing physical flows and supply chains.	Blockchain enhances trust and efficiency in intelligent manufacturing, facilitating data integration, collaborative production, and full life-cycle management.
By verifying product provenance, blockchain confirms authenticity and origin, mitigating risks linked to counterfeit goods and ensuring regulatory compliance.	Blockchain applications in logistics offer advantages such as real-time transparency and cost reduction, enhancing processes and reducing costs in the logistics sector.	Blockchain technology supports sustainability in manufacturing by lowering verification costs, enhancing product quality, and fostering network effects.
Blockchain enhances product and data security, employing cryptographic techniques to safeguard sensitive information and reduce fraudulent activities.	Blockchain provides a secure platform for sharing information about goods, allowing companies to demonstrate product safety and sustainability to consumers.	Blockchain ensures integrity in distributed systems, enabling transparency and cost reduction through consensus algorithms in manufacturing.
Through automation and smart contracts, blockchain optimizes procurement processes, driving down operational costs and ensuring greater accuracy in financial transactions.	Blockchain streamlines processes and reduces costs in logistics by minimizing paperwork and ensuring visibility of critical documents like bills of lading.	Blockchain fosters innovation in manufacturing models by enabling transparency in resources and streamlining collaborative production processes.
The adoption of blockchain marks a transformative shift towards more efficient, secure, and transparent supply chain management practices in procurement.	Blockchain enhances transparency in logistics by providing access to critical data and facilitating information exchange among stakeholders.	Effective adoption of blockchain technology is recommended to support sustainability in manufacturing, driving real-time transparency and cost savings.

6. Future research aspects

The research perspective explores the implications of blockchain technology across various domains, including accounting, marketing, and supply chain management. It investigates how blockchain revolutionizes traditional practices, enhances transparency, and fosters innovation in business processes, paving the way for more efficient and resilient organizational ecosystems.

In accounting, blockchain technology offers transformative potential by revolutionizing how financial transactions are recorded, verified, and audited. Research in this area could focus on exploring the implications of blockchain for financial reporting, audit procedures, and regulatory compliance. Studies may investigate the implementation of blockchain-based ledgers for transparent and tamper-proof financial records, enabling real-time access to transaction data for auditors and regulators. Additionally, research could examine the integration of smart contracts into accounting processes, automating tasks such as invoice processing, revenue recognition, and contract management. Understanding the impact of blockchain on accounting practices is essential for enhancing transparency, accuracy, and trust in financial reporting.

From a marketing perspective, blockchain technology presents opportunities for enhancing customer engagement, loyalty, and trust through transparent and secure transactions. Research in this domain could explore how blockchain-enabled platforms can revolutionize digital marketing strategies, including personalized advertising, customer rewards programs, and supply chain transparency. Studies may investigate the use of blockchain to verify product authenticity, track the origin of goods, and ensure ethical sourcing practices, thereby enhancing brand reputation and consumer confidence. Additionally, research could examine the role of blockchain in facilitating peer-to-peer marketing networks, enabling direct interactions between consumers and brands while eliminating intermediaries. Understanding the impact of blockchain on marketing dynamics is crucial for businesses to adapt and thrive in the digital age.

In the realm of supply chain management, blockchain technology offers unprecedented opportunities for transparency, traceability, and efficiency across the entire value chain. Research in this area could focus on exploring the implementation of blockchain for supply chain optimization, including inventory management, logistics tracking, and supplier collaboration. Studies may investigate the use of blockchain-based platforms to streamline procurement processes, verify product authenticity, and reduce the risk of counterfeit goods. Additionally, research could examine the integration of blockchain with other emerging technologies, such as IoT and AI, to create autonomous supply chain systems that optimize resource allocation and minimize operational

costs (Bhuiyan & Mozumder, 2024). Understanding the implications of blockchain for supply chain management is essential for creating resilient, agile, and sustainable business ecosystems.

Research that combines accounting, marketing, and supply chain perspectives in the context of blockchain technology could explore the broader implications of decentralized ledger systems for business ecosystems. Studies may examine how blockchain-enabled transparency and traceability impact financial reporting, brand reputation, and supplier relationships. Additionally, research could investigate the role of blockchain in enabling collaborative value creation across interconnected business functions, leading to more efficient resource allocation and value delivery. Understanding the synergies between accounting, marketing, and supply chain domains within the context of blockchain technology is essential for developing integrated strategies that leverage the full potential of decentralized digital ecosystems.

7. Conclusion

In conclusion, blockchain technology is revolutionizing various industries by offering innovative solutions to longstanding challenges. Its decentralized nature and immutable ledger system promise enhanced transparency, security, and efficiency in business operations. The financial sector recognizes blockchain as a disruptive force that demands adaptation. This study explores the multifaceted applications of blockchain in accounting, marketing, and supply chain management, shedding light on its potential to drive innovation and improve trustworthiness in business practices. By leveraging blockchain's capabilities, organizations can transform financial record-keeping, marketing data management, and supply chain traceability, ultimately fostering greater transparency, reliability, and efficiency across diverse business domains.

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