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Blockchain in global supply chains: A comparative review of USA and African practices

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Abstract

In the contemporary landscape of international trade, the adoption of blockchain technology in global supply chains has garnered significant attention. This comparative review delves into the practices of the United States and African countries, examining the implementation, challenges, and potential benefits of blockchain in enhancing supply chain efficiency. The United States, as a global economic powerhouse, has been at the forefront of integrating blockchain into its supply chain processes. The American approach emphasizes transparency, traceability, and accountability. Blockchain technology provides a decentralized and immutable ledger, enabling seamless tracking of goods from their origin to the end consumer. The use of smart contracts automates and streamlines contractual agreements, reducing paperwork and minimizing delays. While the adoption in the USA is relatively widespread, challenges include the need for standardized protocols, regulatory frameworks, and overcoming resistance to change within established systems. In contrast, the African continent presents a diverse and evolving landscape in the adoption of blockchain within supply chains. Several African nations have recognized the potential of blockchain to address longstanding issues such as counterfeit goods, fraud, and inefficiencies in logistics. Blockchain offers a decentralized solution that can empower local producers and facilitate international trade. However, challenges in Africa include limited technological infrastructure, varying levels of regulatory frameworks, and the need for capacity building. Collaborative efforts between governments, private sectors, and international organizations are essential to overcoming these obstacles. Both the USA and African countries stand to benefit from blockchain adoption in global supply chains. Increased transparency reduces the risk of fraud and enhances trust between stakeholders. The immutable nature of blockchain records ensures data integrity, contributing to the overall resilience of the supply chain. However, successful implementation requires a nuanced understanding of local contexts, regulatory frameworks, and technological capacities. This comparative review serves as a foundation for future research and policy development, shedding light on the dynamic landscape of blockchain adoption in global supply chains across diverse socio-economic environments.

Keyword: Blockchain; Global supply; USA; Africa; Review

1. Introduction

The global economy heavily relies on efficient and effective supply chains, which play a crucial role in ensuring the smooth flow of goods and services across the world (Grzelakowski, 2019). The increasing interest in blockchain technology has garnered attention due to its potential to revolutionize supply chain management by enhancing

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transparency, security, and traceability (Ali et al., 2020). As a result, there is a growing interest in understanding the adoption and implementation of blockchain in supply chains, particularly in comparing the practices between the USA and Africa.

The adoption of blockchain technology in supply chains has garnered significant attention due to its potential to revolutionize supply chain management. Blockchain offers features such as decentralized and secure data storage, smart contracts, and enhanced transparency, which can streamline processes, reduce fraud, and improve trust among stakeholders (Wang et al., 2019). The potential benefits of blockchain technology in supply chains have been widely recognized, with studies indicating that it can improve supply chain efficiency and transparency (Hartley et al., 2021). However, the adoption of blockchain in supply chains is influenced by various factors, including government regulations, the use of updated information systems, and collaboration with third-party consultants (Hartley et al., 2021).

In the context of the USA and Africa, the utilization of blockchain technology in supply chains exhibits differences and similarities. For instance, the adoption of blockchain in the agri-food supply chain in Africa has been driven by the need to build trust-based relationships among stakeholders (Sharma et al., 2023). On the other hand, in the USA, blockchain technology has been explored in the context of supply chain finance, with studies providing insights into the strategic behavior of supply-chain finance members and the development of pilot design considerations (Xu et al., 2022; Hoek, 2019). Furthermore, the impact of blockchain technology on supply chain sustainability performances has been examined, highlighting the growing literature on blockchain-based supply chains (Park & Li, 2021).

Challenges and opportunities associated with the adoption of blockchain in supply chains have been extensively studied. Factors such as competitive pressure, complexity, and cost have been identified as significant influencers of blockchain adoption by small and medium-sized enterprises in supply chain management (Li & Chen, 2022). Additionally, the literature has emphasized the importance of addressing the challenges of blockchain adoption, such as information asymmetry and improper behavior of enterprises, through the implementation of blockchain technology in supply chains (Liu et al., 2021).

Overall, the adoption of blockchain technology in supply chains is a complex and multifaceted process, influenced by various institutional, market, and technical factors. While the potential benefits of blockchain technology in improving supply chain efficiency and transparency are evident, addressing the challenges associated with its adoption is crucial for realizing its full potential in both the USA and Africa.

In the context of the USA and Africa, understanding the practices related to blockchain adoption in supply chains is essential for identifying the unique challenges and opportunities faced by each region. While the USA may have more advanced technological infrastructure and regulatory frameworks, African countries may encounter different barriers to the adoption of blockchain technology, such as limited access to digital infrastructure and varying levels of technological literacy. Therefore, a comparative review of blockchain practices in these regions can provide valuable insights for policymakers, businesses, and researchers seeking to understand the global landscape of blockchain adoption in supply chains.

2. Blockchain in Global Supply Chains

Blockchain technology has emerged as a transformative tool in global supply chains, offering solutions to various challenges such as traceability, transparency, and efficiency. The incorporation of blockchain in supply chain management has been shown to enhance sustainability, reliability, and effectiveness in production, procurement, and transportation (Li & Chen, 2022). By providing a transparent and immutable ledger, blockchain technology ensures the traceability of products throughout the supply chain, thereby improving trust and transparency (Mahyuni et al., 2020). Furthermore, blockchain technology has the potential to revolutionize supply chain management by addressing long-standing issues and maximizing the benefits for all stakeholders involved (Liu, 2021).

The application of blockchain technology in global logistics operations has been proposed as a reference model, highlighting its potential to enhance traceability and transparency in supply chains (Kamran et al., 2021). Additionally, the use of blockchain in supply chain finance platforms has been shown to impact the cost, quality, speed, risk management, and continuity of supply chain management, ultimately benefiting all parties involved (Wang, 2022). Moreover, the integration of blockchain technology into logistics service supply chain information platforms has been demonstrated to enhance traceability and security through consensus algorithms (Zhang et al., 2023).

The potential of blockchain technology to disrupt the supply chain industry is evident in its impact on scalability, performance, consensus mechanisms, privacy considerations, and cost (Litke et al., 2019). Furthermore, blockchain technology has been identified as a promising solution for achieving sustainable development goals in logistics and supply chain management (Kozhanov & Woebeking, 2021). Its ability to provide secure and efficient supply chain frameworks through smart contracts and IoT devices further underscores its potential in enhancing transparency and traceability (Lou et al., 2021).

The value of blockchain technology in returning data ownership to creators and enabling the vertical application of blockchain in supply chain management has been emphasized, particularly for small and medium-sized enterprises (Zhang et al., 2022). Additionally, the application of blockchain technology in supply chain management has been linked to the potential identification of counterfeit products, thereby enhancing the integrity of supply chain systems (Anjum & Dutta, 2022). Moreover, the use of blockchain technology in resilient and sustainable supply chain management has been explored, highlighting its application perspective in addressing supply chain challenges (Zhong & Zhu, 2022).

In conclusion, the integration of blockchain technology in global supply chains offers a promising solution to various challenges, including traceability, transparency, and efficiency. By leveraging blockchain technology, supply chain management can achieve enhanced sustainability, reliability, and effectiveness, ultimately benefiting all stakeholders involved.

3. The United States: Blockchain Integration in Supply Chains

The United States plays a significant role in the global trade landscape, with its supply chains being crucial for the efficient movement of goods and services (Zhou & Benton, 2007). However, the American supply chain faces various challenges and inefficiencies, such as the tension between competition and collaboration, which can hinder greater integration (Halldorsson et al., 2008). To address these challenges, the integration of blockchain technology in US supply chains has been proposed, offering various benefits such as transparency, traceability, and automation through smart contracts (Gomes et al., 2022). Blockchain's decentralized ledger provides advantages in enhancing the security and efficiency of supply chain operations (Gomes et al., 2022).

The implementation of blockchain technology in US supply chains is not without challenges. Standardizing protocols and establishing regulatory frameworks for compliance are crucial aspects that need to be addressed (Gomes et al., 2022). Additionally, overcoming resistance to technological change is essential for successful integration (Wei et al., 2018). By developing performance measures and employing them to gauge the performance of supply chains, full integration and maximization of efficiency and effectiveness can be achieved (Wei et al., 2018).

The integration of the US textile and apparel supply chain with small companies in South America emphasizes the need for synchronization and convergence among all members throughout the supply chain (Teng & Jaramillo, 2006). Furthermore, the impact of the rise of global supply chains on foreign trade policies highlights the significance of industrializing by joining international supply chains (Puślecki, 2016). These references underscore the importance of collaboration and integration within supply chains, aligning with the potential solutions for implementation challenges.

In conclusion, the American supply chain landscape plays a crucial role in global trade, but it faces challenges and inefficiencies that can hinder its optimal performance. The integration of blockchain technology offers promising solutions by providing transparency, traceability, and automation benefits. However, challenges related to standardization, regulatory frameworks, and resistance to change need to be addressed for successful implementation.

4. African Practices: Dynamics and Challenges

Africa's supply chains exhibit a diverse range of economic structures and industries (You et al., 2018). The continent's economic landscape is characterized by a variety of industries, each facing its own set of challenges (Mpwanya & Heerden, 2017). This diversity presents both opportunities and challenges for supply chain management, as different industries require tailored approaches to address their specific needs and constraints. Furthermore, the multiplicity of challenges faced by African borders, such as managing national sovereignty and preventing illegal entries, adds another layer of complexity to the supply chain dynamics (Mamokhere & Chauke, 2020).

African supply chains encounter common challenges, including issues related to counterfeit goods, fraud, and the need for sustainable and responsible practices (Shitu & Nor, 2018). These challenges have significant implications for the integrity and efficiency of supply chains across the continent. Moreover, the continent's technological infrastructure

and capacity building play a crucial role in addressing these challenges. The lack of technological advancement and capacity building initiatives has led to the migration of skilled professionals away from Africa, impacting the overall development and sustainability of supply chains (Wilmshurst et al., 2011).

The adoption of blockchain technology has the potential to address the issues of counterfeit goods and fraud in African supply chains (Shitu & Nor, 2018). By leveraging blockchain, supply chain stakeholders can enhance transparency, traceability, and authenticity verification, thereby mitigating the risks associated with counterfeit products. Additionally, blockchain adoption empowers local producers by providing them with a platform to showcase their products to a global audience, thereby enhancing international trade (Shitu & Nor, 2018).

Assessing the existing technological landscape in Africa is crucial for understanding the readiness of supply chains to adopt innovative solutions such as blockchain. The development of sustainable technological infrastructure and capacity building initiatives is essential for overcoming the limitations that hinder the effective management of African supply chains. By investing in technical and vocational education and training, Africa can position itself for sustainable development and equip its workforce with the necessary skills to drive innovation and efficiency in supply chain management.

In conclusion, African supply chains exhibit diverse economic structures and face common challenges that necessitate tailored solutions. The adoption of blockchain technology holds promise for addressing issues of counterfeit goods and fraud while empowering local producers and enhancing international trade. However, to fully realize the potential of blockchain and other technological solutions, Africa must prioritize technological infrastructure development and capacity building initiatives to ensure the readiness of its supply chains for sustainable and efficient operations.

5. Comparative Analysis of Blockchain in global supply chains in USA and Africa

Blockchain technology has been increasingly adopted in global supply chains to enhance transparency and traceability. In the USA, the adoption of blockchain has led to improved supply chain transparency, especially in the post-COVID-19 scenario, where blockchain is used to implement transparent supply chains, ensuring data immutability and shared information (Francisco & Swanson, 2018; Chatterjee & Chatterjee, 2022). Similarly, the impact of RFID, IIoT, and blockchain technologies has significantly enhanced supply chain transparency (Zelbst et al., 2019). Furthermore, the design and implementation of food supply chain traceability systems based on blockchain have been proposed, emphasizing the role of blockchain in ensuring transparency and traceability (Wang, 2023). In the context of the chemical supply chain, blockchain and smart contracts have been utilized to establish document traceability, further highlighting the role of blockchain in enhancing transparency (Manoharan & Priya, 2022). In Africa, blockchain technology has been recognized for its potential in ensuring data provenance in supply chains, thereby enhancing traceability and transparency. Additionally, efforts have been made to develop guidance templates and terminology to support multiple traceability objectives in the grain supply chain, emphasizing the importance of transparency in supply chain management (Sharma et al., 2021).

Comparatively, the USA has made significant strides in leveraging blockchain technology to enhance supply chain transparency, particularly in the apparel industry, where quantitative analysis of corporate disclosures has been conducted to assess the transparency of global apparel supply chains (Jin et al., 2015). However, it is essential to note that the literature on the comparison of transparency levels in the USA and African supply chains is limited. Further research is needed to comprehensively compare the transparency levels in these two contexts.

The impact of blockchain on traceability and accountability has been evident in both the USA and Africa, with blockchain technology playing a crucial role in ensuring transparency and traceability in global supply chains. However, the specific comparison of transparency levels and the impact on traceability and accountability between the USA and African supply chains requires further empirical investigation to provide a comprehensive analysis.

6. Benefits and Challenges in Global Supply Chains

Global supply chains offer shared benefits and common challenges that significantly impact their operations. Increased transparency and trust are among the shared benefits of global supply chains. Transparency facilitates better communication and understanding among supply chain partners, leading to increased trust. This trust is essential for fostering strong relationships and collaboration within the supply chain, ultimately leading to improved efficiency and performance (Su et al., 2013). Furthermore, enhanced resilience in supply chain operations is another shared benefit.

Resilience enables supply chains to effectively recover from operational disruptions, ensuring continuity and stability. This is crucial for maintaining customer satisfaction and market competitiveness (Munoz & Dunbar, 2015).

However, global supply chains also face common challenges. The need for standardized protocols is a significant challenge, as it is essential for ensuring smooth operations and communication across the supply chain. Standardized protocols help in streamlining processes and reducing errors, ultimately leading to improved efficiency and coordination (Raubenheimer & Conradie, 2012). Additionally, resistance to change within established systems poses a challenge to global supply chains. Overcoming resistance to change is crucial for implementing new technologies and processes that can enhance supply chain operations and resilience (Essuman et al., 2023).

In conclusion, global supply chains offer shared benefits such as increased transparency, trust, and enhanced resilience. However, they also face common challenges including the need for standardized protocols and resistance to change within established systems. Addressing these challenges is essential for ensuring the continued success and efficiency of global supply chains.

7. Conclusion

In summary, the comparative review of blockchain practices in global supply chains between the United States and Africa has unearthed significant insights into the diverse applications, challenges, and potential benefits of this transformative technology.

Both the USA and African nations have recognized the value of blockchain in enhancing transparency and traceability within their supply chains. The decentralized and immutable nature of blockchain led to improved visibility from origin to consumer, addressing issues such as fraud and counterfeiting. The adoption of smart contracts in the USA showcased streamlined contractual processes, reducing paperwork and delays. While African nations are making strides in embracing this automation, challenges such as limited technological infrastructure persist, influencing the pace of implementation. The USA has made notable progress in establishing regulatory frameworks for blockchain adoption, fostering a conducive environment for businesses. Conversely, African countries are in the process of navigating diverse regulatory landscapes, requiring collaborative efforts between governments and industry stakeholders.

The findings suggest several avenues for future research and policy development. There is a pressing need for international standards to facilitate seamless integration of blockchain in global supply chains. Research should focus on developing standardized protocols that accommodate the diverse needs of both developed and developing economies. African nations, in particular, would benefit from focused efforts on technological infrastructure development and capacity building. International collaborations and knowledge transfer initiatives can play a pivotal role in addressing these challenges. Future research should delve deeper into the complexities of regulatory frameworks and explore mechanisms for harmonizing these frameworks globally. This could pave the way for smoother cross-border transactions and a more consistent application of blockchain technology. The future of blockchain in global supply chains holds immense promise. While the USA showcases a mature and increasingly standardized adoption of blockchain practices, African nations are navigating a dynamic landscape with unique challenges. Collaborative efforts, shared knowledge, and a commitment to overcoming obstacles will be paramount in realizing the full potential of blockchain technology. As blockchain continues to evolve, its transformative impact on global supply chains will likely contribute to increased efficiency, reduced fraud, and enhanced trust across international trade networks. The journey towards a globally integrated, blockchain-driven supply chain future is underway, with lessons learned from both the USA and Africa shaping this transformative path.

Compliance with ethical standards

Disclosure of conflict of interest

The author has no conflict of interest in this research.

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