J-CEKI : Jurnal Cendekia Ilmiah
Vol.4, No.2, Februari 2025

The Use of Blockchain Technology to Increase the Effectiveness of Supply Management Information for Logistic Enhancement (SMILE) based on Project Management Office in PT Telekomunikasi Indonesia

Liza Mahavianti Syamsuri[1], Eryda Listyaningrum[2]
[1]Business Administration, Faculty of Economics and Business, Telkom University
[2]Direktorat Pemanfaatan Riset dan Inovasi pada Kementerian/Lembaga, Masyarakat dan UMKM Badan Riset dan Inovasi Nasional, Jakarta Pusat
E-mail: lizamahavianti@telkomuniversity.ac.id[1], erd001@brin.go.id[2]

Article History:
Received: 04 Desember 2024
Revised: 10 Januari 2025
Accepted: 14 Januari 2025

Keywords: *Blockchain Technology, Supply Management Information for Logistic Enhancement (SMILE), Project Management Office, PT Telekomunikasi Indonesia.*

Abstract: *The successful integration of blockchain technology into PT Telkom Indonesia's SMILE (Supply Management Information for Logistic Enhancement) system requires a structured and strategic approach. This study presents a comprehensive framework addressing technological, organizational, and regulatory aspects to ensure effective blockchain implementation. Recommendations include a phased implementation starting with pilot projects, integration of smart contracts to automate processes, and robust cybersecurity measures to safeguard data. Stakeholder engagement and training are emphasized to foster collaboration and acceptance, while adherence to regulatory compliance ensures alignment with legal requirements. The system's interoperability, platform selection, and sustainability considerations, such as energy-efficient consensus mechanisms, further enhance its functionality and environmental responsibility. Regular performance assessments using key performance indicators (KPIs) and partnerships with technology providers and academic institutions are suggested to drive continuous improvement and innovation. This framework positions PT Telkom Indonesia to optimize its supply chain operations and expand blockchain adoption across various organizational functions, setting a benchmark in the telecommunications industry.*

INTRODUCTION

PT Telekomunikasi Indonesia (Telkom), as a leading telecommunications company in Indonesia, faces complex challenges in managing its supply chain. The company's supply management information for logistic enhancement (SMILE) system plays a crucial role in

optimizing logistics operations. However, traditional SMILE systems can be vulnerable to data breaches, lack transparency, and face inefficiencies. Blockchain technology offers a potential solution to address these challenges. The research question is “How can blockchain technology be implemented in PT Telkom's SMILE system to enhance its effectiveness, particularly in terms of security, transparency, and efficiency?”. The objectives of the research are: a) evaluating the current state of PT Telkom's SMILE system and identify its limitations b) exploring the potential benefits of blockchain technology in enhancing SMILE, c) developing a framework for implementing blockchain technology in PT Telkom's SMILE system, d) assessing the potential challenges and risks associated with blockchain implementation and e) providing recommendations for PT Telkom based on the research findings.

LITERATURE REVIEW

Blockchain technology is widely recognized as one of the most significant and innovative technological advancements in recent years (Peters and Panayi 2016; Pilkington 2016; Pricewaterhouse Coopers [PwC] 2015; Swan 2015) Originally created for Bitcoin trading, it provides a decentralized public ledger that enables secure transactions among unfamiliar parties without the need for a central authority. This technology has the potential to lower trading costs, expedite transaction settlement times, mitigate the risk of fraud, enhance the auditability of transactions, and improve monitoring capabilities. A private blockchain, for example, can provide security, timeliness and transparency to all its users with clear potential applications in operations and supply chain management (OSCM) (Pilkington, 2016). Blockchain can provide a permanent, shareable, auditable record of products through the supply chain, which improves product traceability, authenticity, and legality in a more cost-effective way (Dursun, et al., 2022).

Meanwhile, SCM encompasses not only planning and controlling the flow of materials from suppliers to end users (logistics-based SCM), but also the philosophy adopted by a company toward supplier relationships (strategic SCM) (Albright & Davis,1999).

The information systems plays various roles in supply chain management including: Inventory management, demand forecasting, order processing and fulfilment, logistics and transportation management, Supplier Relationship Management (SRM), etc (Priyadarshini, 2024). According to Valinejad & Rahmani (2018), in terms of sustainability, the most dangerous risks in the telecommunication companies are technical and institutional ones, which account for almost 66% of the critical risks. In addition, suppliers with a 53% share of critical risks are the most threatening to sustain the supply chain.

SMILE (Supply Management Information for Logistics Enhancement) is a logistics management online web application providing solutions to Logistics Functional Units (LFU), that manage the program, projects or other activities in detail, simply, and easy. SMILE is an end-to-end process controlling and application monitoring supply management integrated into the process procurement and construction that makes things easier and speed up the supply process (Telkom Indonesia, 2015). According to Ningrum, Rizal & Pratama (2023), despite the common issues of information system, the possibility of corruption and nepotism occurring in the procurement process and the probability of procurement process failure internal.

METHOD

To examine PT Telkom's SMILE (Supply Management Information for Logistic Enhancement) system and evaluate its potential for blockchain implementation, a structured methodology combining both qualitative approaches is essential. This approach ensures a holistic

understanding of the current system, its limitations, and the feasibility of blockchain integration.

The process begins with mapping of the SMILE system to capture its workflows, processes, and functionalities. This step involves reviewing existing documentation and operational guidelines. This engagement highlights areas where blockchain could address challenges, such as data inconsistencies, fraud, and inefficiencies.

Identifying pain points within the SMILE system is critical to this methodology. This involves examining historical data, such as transaction records and incident reports, to uncover recurring issues like payment delays, data discrepancies, or supply chain bottlenecks. A cost-benefit analysis determines the financial viability of blockchain deployment by comparing the required investment with potential savings from increased efficiency and reduced fraud. Risk assessments explore potential challenges, such as regulatory compliance issues, stakeholder resistance, and system integration complexities.

RESULT AND DISCUSSION

Challenges in Implementing Blockchain in PT Telkom

To date there are 842 active vendors registered with SMILE. The modules consists of: Contract management, contact drafting, e-catalogue, price database, QR Code Validation, Online deployment supervision, spending dashboard, support asset management, online invoice, Telegram notification, mobile app supported, vendor questioner, master data vendor and vendor performance.



Figure 1. The modules of SMILE

The implementation of blockchain technology in PT Telkom Indonesia's SMILE (Supply Management Information for Logistic Enhancement) platform faces various challenges that impact its feasibility and success. While blockchain holds potential for improving supply chain efficiency, transparency, and data security, it also comes with specific technological, organizational, and external barriers. These challenges can be categorized into technical limitations, organizational resistance, regulatory and legal issues, financial implications, and the need for stakeholder alignment.

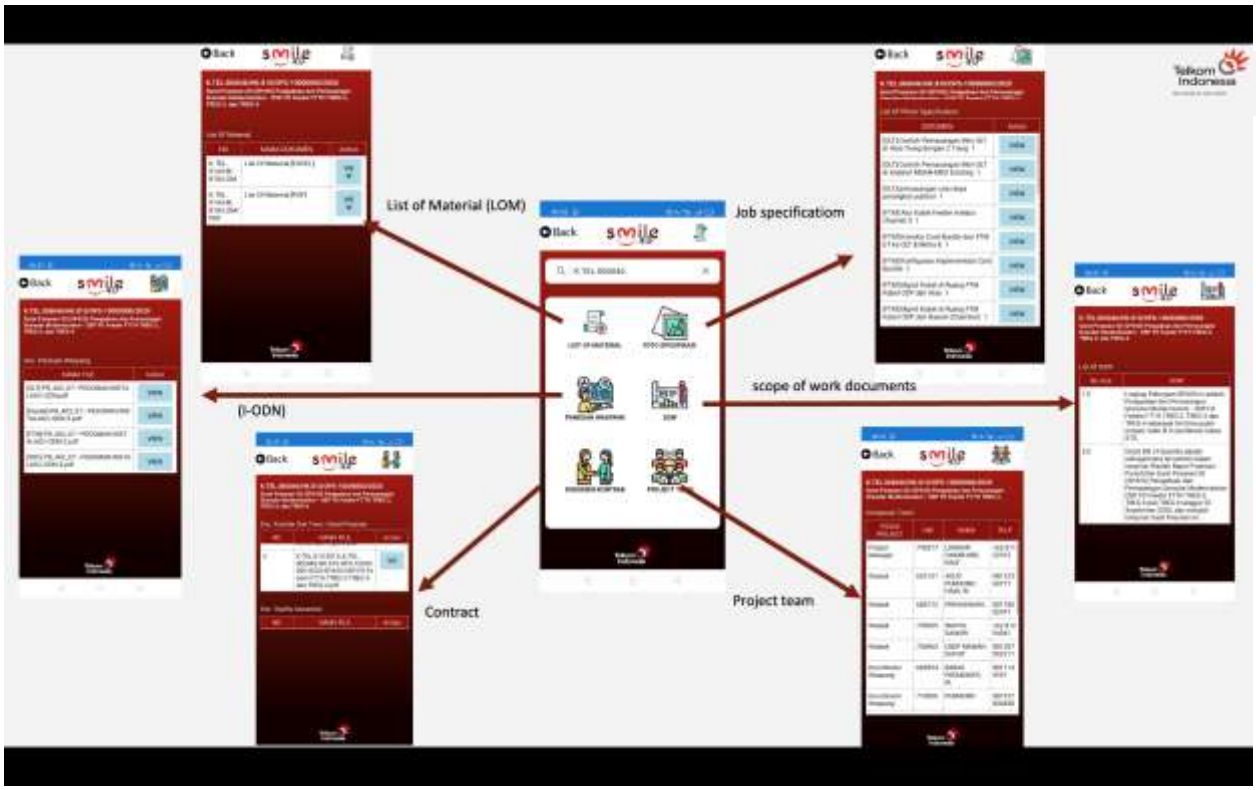


Figure 2. Mobile app SMILE

One significant challenge is the technical complexity of integrating blockchain technology into an existing supply chain system like SMILE. Blockchain requires a robust digital infrastructure capable of handling a decentralized ledger, secure data storage, and seamless communication among various stakeholders. PT Telkom Indonesia would need to upgrade its existing systems to ensure compatibility with blockchain protocols. This presents an opportunity for growth and development within the company. Moreover, blockchain implementation in a supply chain involves managing large volumes of data transactions. This high data throughput demands advanced computing resources and storage solutions, which could strain the existing infrastructure. Technical scalability also poses a challenge, as the blockchain must accommodate growth in the number of transactions and participants without compromising speed or efficiency (Saberi et al., 2019).

Another significant challenges is the scarcity of skilled professionals in Indonesia who can manage blockchain integration and operations. The implementation and maintenance of blockchain technology demand expertise in distributed ledger systems, cryptography, and smart contracts. However, there is a limited pool of professionals with such skills in the country, making it a daunting task for PT Telkom Indonesia to find the necessary talent. Moreover, training existing employees on blockchain concepts and their application to SMILE could be a time-consuming and resource-intensive process, further delaying the project.

Organizational resistance is another major issue. However, the role as stakeholders and decision-makers is crucial in overcoming this challenge. Blockchain represents a paradigm shift in how information is shared and managed. Traditional supply chain systems are often centralized, where a single entity controls data flow and decision-making. Blockchain, on the other hand, decentralizes these processes, requiring a cultural shift within the organization. Employees and

management accustomed to centralized control may resist adopting a decentralized system, fearing a loss of authority or job redundancy. Resistance to change could also stem from uncertainty regarding the technology's effectiveness, given that blockchain is still relatively new in large-scale supply chain applications (Queiroz & Wamba, 2019). The regulatory environment in Indonesia poses additional challenges for blockchain adoption. Blockchain operates across decentralized networks, making it difficult to align with existing regulations that govern centralized systems. In supply chain management, regulatory compliance often involves adhering to specific standards for data privacy, transparency, and accountability. Blockchain's immutability, while an advantage in terms of data integrity, can create conflicts with data privacy laws such as Indonesia's Personal Data Protection Law (PDP Law). For instance, once data is recorded on a blockchain, it cannot be altered or deleted, which might contradict legal requirements for data modification or erasure in certain cases.

Financial constraints also play a critical role in hindering blockchain adoption in SMILE. Developing and deploying blockchain technology is expensive. The costs include hardware and software upgrades, employee training, and ongoing maintenance of the system. However, the potential risks of not adopting blockchain in SMILE can be even more costly. These risks include increased operational inefficiencies, higher chances of fraud, and a lack of transparency in the supply chain. Therefore, justifying such a high upfront investment requires evidence of substantial long-term benefits. However, the return on investment for blockchain projects can be uncertain due to the nascent stage of the technology and the potential for unforeseen technical or operational challenges. This financial risk makes organizations hesitant to adopt blockchain, especially for a critical platform like SMILE, which already supports key supply chain functions.

The interoperability of blockchain with existing systems also presents a significant challenge. SMILE likely operates on traditional database systems designed for centralized information storage and retrieval. Integrating blockchain with such systems requires the development of middleware or APIs to enable seamless data exchange between blockchain networks and existing software. This integration process can be complex, time-consuming, and prone to errors. Moreover, blockchain adoption requires all supply chain stakeholders, including suppliers, distributors, and logistics providers, to adopt compatible technologies, which can be difficult to coordinate (Kamble et al., 2020).

Cybersecurity and data privacy concerns further complicate blockchain implementation. While blockchain is inherently secure due to its cryptographic features, it is not immune to cyberattacks. For example, vulnerabilities in smart contracts or blockchain protocols can be exploited by malicious actors, leading to data breaches or unauthorized transactions. PT Telkom Indonesia must ensure that its blockchain implementation includes robust cybersecurity measures to protect sensitive supply chain data. Additionally, blockchain's transparency can create privacy challenges, as all participants in the network can access certain transaction details. Balancing transparency with privacy is crucial to avoid exposing sensitive business information to unauthorized parties.

Stakeholder alignment is a critical barrier that needs to be addressed. The success of blockchain in supply chain management depends on the participation and cooperation of all stakeholders in the network. For PT Telkom Indonesia's SMILE platform, this includes suppliers, manufacturers, logistics providers, and customers. Achieving consensus among such diverse stakeholders can be challenging due to differing priorities, technological capabilities, and levels of trust in blockchain technology. However, the need for cooperation and collaboration is paramount to overcome these challenges. Some stakeholders may resist adopting blockchain due to concerns

about data sharing, loss of competitive advantage, or the cost of upgrading their systems.

The lack of standardized blockchain frameworks for supply chain management also poses a challenge. Different blockchain platforms, such as Ethereum, Hyperledger, and Corda, offer varying features and capabilities. Choosing the right platform for SMILE requires careful consideration of scalability, security, and compatibility with existing systems. Furthermore, the absence of industry-wide standards for blockchain implementation in supply chains can lead to fragmentation, making it difficult for organizations to achieve interoperability and consistent performance across the network (Casino et al., 2019).

Finally, cultural and market-specific factors in Indonesia could influence blockchain adoption. Indonesia's supply chain ecosystem is characterized by diverse stakeholders, ranging from large multinational corporations to small and medium-sized enterprises (SMEs). Many SMEs may lack the resources or technical expertise to participate in a blockchain-based supply chain. This disparity in technological readiness can create gaps in the network, limiting the overall effectiveness of the blockchain implementation. Additionally, the cultural emphasis on traditional business practices and face-to-face interactions in Indonesia could hinder the adoption of a technology-driven approach like blockchain.

To address these challenges, PT Telkom Indonesia needs to adopt a strategic and phased approach to blockchain implementation. Initial efforts could focus on pilot projects that test the technology's feasibility in specific supply chain processes, such as inventory management or logistics tracking. These pilots can provide valuable insights into the technology's performance and help identify potential issues before full-scale implementation. The importance of careful planning and execution in these pilot projects is crucial. Collaboration with academic institutions, technology providers, and government agencies can also help overcome technical and regulatory barriers. Establishing partnerships with these stakeholders can facilitate knowledge sharing, skill development, and the creation of a supportive regulatory framework for blockchain adoption.

Moreover, PT Telkom Indonesia should invest in change management programs to address organizational resistance. These programs can include workshops, training sessions, and awareness campaigns to educate employees and management about the benefits of blockchain and how it aligns with the organization's goals. Building trust among stakeholders is equally important. Transparent communication, clear policies on data governance, and the demonstration of successful pilot projects can help build confidence in the technology.

Addressing financial constraints requires a focus on cost-benefit analysis and long-term planning. PT Telkom Indonesia can explore partnerships with technology providers to reduce initial investment costs and share the financial burden. Additionally, leveraging blockchain's cost-saving potential in areas such as fraud prevention, operational efficiency, and dispute resolution can help justify the investment. For instance, blockchain can significantly reduce the costs associated with fraud by providing a transparent and immutable record of transactions. Similarly, it can improve operational efficiency by automating certain supply chain processes. By highlighting these potential cost-saving benefits, PT Telkom Indonesia can help stakeholders see the value of the investment and the potential return on investment.

In terms of regulatory compliance, PT Telkom Indonesia should work closely with policymakers to ensure that blockchain implementation aligns with existing laws and regulations. Collaborating with industry associations can also help establish standardized frameworks for blockchain adoption in Indonesia's supply chain sector. These standards can promote interoperability, reduce fragmentation, and create a level playing field for all stakeholders.

In conclusion, while blockchain technology offers significant potential for enhancing the

SMILE platform, its implementation in PT Telkom Indonesia faces a range of challenges. These include technical complexity, organizational resistance, regulatory and legal issues, financial constraints, interoperability challenges, cybersecurity concerns, and stakeholder misalignment. Addressing these challenges requires a comprehensive strategy that combines technological innovation, stakeholder collaboration, regulatory alignment, and cultural adaptation. By taking a phased and collaborative approach, PT Telkom Indonesia can unlock the benefits of blockchain technology and strengthen its supply chain capabilities.

CONCLUSION AND RECOMMENDATION

To enhance the implementation of blockchain technology in PT Telkom Indonesia's SMILE (Supply Management Information for Logistic Enhancement), a detailed recommendation framework must be established. This framework should encompass technological, organizational, and regulatory aspects to ensure a seamless and effective integration of blockchain into the existing supply chain infrastructure (Chen, Li, & Yi, 2021)

The first recommendation involves adopting a phased approach to blockchain implementation (Saberi, Kouhizadeh, Sarkis & Shen,2019). This approach, instead of overhauling the entire supply chain management system at once, allows PT Telkom Indonesia to initiate a pilot project that focuses on specific aspects of the supply chain. For example, the company could begin by using blockchain to enhance vendor contract management or streamline procurement processes. This phased approach not only allows PT Telkom to test the technology in a controlled environment, identify challenges, and refine the system before scaling it up across the organization, but also reassures stakeholders about the manageable nature of the transition. By starting with a pilot, the company can demonstrate the tangible benefits of blockchain to stakeholders, thereby fostering greater acceptance and collaboration.

The integration of smart contracts into SMILE is another critical recommendation (Xu, Weber, & Staples, 2019). Smart contracts are self-executing agreements with predefined rules and conditions encoded within the blockchain. By automating processes such as payment release, goods acceptance, and compliance verification, smart contracts reduce the reliance on manual intervention, minimize errors, and ensure timely execution of tasks. For instance, PT Telkom can deploy smart contracts to automatically process payments to suppliers once goods are delivered and meet the specified quality standards. This automation not only enhances efficiency but also builds trust among suppliers by ensuring transparency and fairness in transactions.

Another crucial recommendation is to invest in robust cybersecurity measures to protect the blockchain system from potential threats (Conti et al., 2018). While blockchain technology is inherently secure due to its decentralized and cryptographic nature, it is not entirely immune to attacks. PT Telkom should implement additional layers of security, such as multi-factor authentication, secure access protocols, and regular system audits, to safeguard sensitive supply chain data. Training employees on cybersecurity best practices and establishing a dedicated cybersecurity team will further enhance the resilience of the blockchain system.

To ensure the successful adoption of blockchain technology, PT Telkom must also focus on stakeholder engagement and training (Kouhizadeh, Sarkis, & Zhu, 2020). The implementation of blockchain requires active participation from various stakeholders, including suppliers, vendors, and internal teams. Their role is not just crucial, but integral to the success of the initiative. Resistance to change or a lack of understanding of blockchain technology can hinder its adoption. PT Telkom should organize workshops, training sessions, and awareness campaigns to educate stakeholders about the benefits of blockchain and how it enhances supply chain processes. By

fostering a culture of collaboration and knowledge-sharing, the company can ensure that all participants feel valued and are aligned with the goals of the blockchain initiative.

Regulatory compliance is a crucial aspect of blockchain implementation (Finck, 2019). PT Telkom operates in a complex regulatory environment that governs data privacy, procurement, and logistics. The company must ensure that its blockchain-based SMILE system adheres to all relevant regulations, both at the national and international levels. Collaborating with legal experts and regulators can help PT Telkom navigate these complexities and develop a compliant blockchain solution. Additionally, the company should engage in industry forums and standard-setting organizations to stay updated on emerging regulatory trends and best practices.

Another key recommendation is to focus on interoperability and integration (Mingxiao, et al., 2017). PT Telkom's supply chain operations involve multiple stakeholders, each of whom may use different systems and technologies. To ensure seamless communication and data exchange, the blockchain system should be designed to integrate with existing enterprise resource planning (ERP) systems, procurement platforms, and other supply chain management tools. Utilizing open standards and APIs can facilitate interoperability, enabling PT Telkom to maximize the benefits of blockchain technology without disrupting existing workflows.

From a technical perspective, PT Telkom should carefully evaluate the choice of blockchain platform for SMILE (Zheng, et al., 2018). Public blockchains, such as Ethereum, offer transparency and decentralization but may not be suitable for enterprise use due to scalability and privacy concerns. Private or permissioned blockchains, such as Hyperledger Fabric, provide greater control over access and data confidentiality, making them a more appropriate choice for PT Telkom. The company should consider factors such as scalability, transaction speed, and ecosystem support when selecting a blockchain platform.

Sustainability is another important consideration in the implementation of blockchain technology (Sedlmeir, et al., 2020) As a responsible corporate entity, PT Telkom is committed to addressing the environmental impact of blockchain operations. This commitment is reflected in the adoption of energy-efficient consensus mechanisms, such as proof-of-stake or delegated proof-of-stake, to minimize the carbon footprint of the blockchain system. Additionally, PT Telkom can explore the use of renewable energy sources to power its blockchain infrastructure, further reinforcing its commitment to sustainability and reassuring stakeholders about its responsible corporate practices.

To evaluate the effectiveness of the blockchain implementation, PT Telkom should establish key performance indicators (KPIs) and conduct regular assessments (Casino, et al., 2019). Metrics such as transaction speed, cost savings, error rates, and stakeholder satisfaction can provide valuable insights into the performance of the blockchain system. These assessments will help PT Telkom identify areas for improvement and make informed decisions to optimize the system. Engaging third-party auditors to review the blockchain implementation can also enhance transparency and accountability.

Collaborating with technology partners and academic institutions is another valuable recommendation (Tapscott & Tapscott, 2016). Blockchain technology is a rapidly evolving field, and staying ahead of the curve requires access to the latest knowledge and expertise. PT Telkom can partner with blockchain technology providers to access cutting-edge solutions and technical support. Collaborations with universities and research organizations can also facilitate the development of innovative use cases and applications for blockchain in supply chain management.

Lastly, PT Telkom should adopt a long-term vision for blockchain implementation (Swan, 2015). While the initial focus may be on addressing immediate challenges in the supply chain, the

company should explore opportunities to expand the use of blockchain technology to other areas of its operations. For example, blockchain can be used to enhance customer relationship management, enable secure data sharing, and support digital identity verification. By adopting a holistic approach to blockchain adoption, PT Telkom can unlock its full potential and drive innovation across the organization.

In conclusion, the successful implementation of blockchain technology in PT Telkom Indonesia's SMILE system requires a comprehensive and strategic approach (Nakamoto, 2008). By adopting a phased implementation, leveraging smart contracts, enhancing cybersecurity, and ensuring regulatory compliance, PT Telkom can overcome the challenges associated with blockchain adoption. Stakeholder engagement, technical integration, and sustainability considerations further contribute to the effectiveness of the blockchain system. Regular assessments and collaborations with technology partners and academic institutions will enable PT Telkom to continuously improve and expand its blockchain capabilities. With a long-term vision and commitment to innovation, PT Telkom Indonesia can set a benchmark for blockchain adoption in supply chain management and solidify its position as a leader in the telecommunications industry.

REFERENCES

Albright, T., & Davis, S. (1999). The elements of supply chain management. International Journal, 49, 50-65.

Saakshi, Priyadarshini, 14 Crucial Applications and Role of IT in Supply Chain Management, 30 April 2024 retrieve on 3 September 2024 from: https://www.guvi.in/blog/role-of-it-in-supply-chain-management/#:~:text=Here's%20how%20IT%20plays%20a%20major%20role%20in%20enhancing%20demand,future%20demand%20with%20higher%20accuracy.

Bumblauskas, D., Mann, A., Dugan, B., & Rittmer, J. (2020). A blockchain use case in food distribution: Do you know where your food has been? *International Journal of Information Management, 52,* 102008. https://doi.org/10.1016/j.ijinfomgt.2019.09.004

Casino, F., Dasaklis, T. K., & Patsakis, C. (2019). A systematic literature review of blockchain-based applications: Current status, classification, and open issues. *Telematics and Informatics, 36,* 55-81. https://doi.org/10.1016/j.tele.2018.11.006

Chen, T., Li, X., & Yi, J. (2021). Blockchain adoption in supply chain management: A framework for decision-making and evaluation. *Journal of Business Logistics, 42*(2), 186-200.

Conti, M., Kumar, S., Lal, C., & Ruj, S. (2018). A survey on security and privacy issues of blockchain technology. *IEEE Communications Surveys & Tutorials*, *21*(2), 1023-1074.

Dursun, T. et al. (2022). Blockchain Technology for Supply Chain Management. In: Calisir, F. (eds) Industrial Engineering in the Internet-of-Things World. GJCIE 2020. Lecture Notes in Management and Industrial Engineering. Springer, Cham.

Francisco, K., & Swanson, D. (2018). The supply chain has no clothes: Technology adoption of blockchain for supply chain transparency. *Logistics*, *2*(1), 2. https://doi.org/10.3390/logistics2010002

Finck, M. (2019). Blockchain regulation and governance in Europe. *Cambridge University Press.*

Kamble, S. S., Gunasekaran, A., & Sharma, R. (2020). Modeling the blockchain-enabled traceability in agriculture supply chain. *International Journal of Information Management, 52,* 101967. https://doi.org/10.1016/j.ijinfomgt.2019.05.023

Kouhizadeh, M., Sarkis, J., & Zhu, Q. (2020). At the nexus of blockchain technology, the circular economy, and sustainable supply chain management. *Transportation Research Part E: Logistics and Transportation Review, 143*, 102086.

Kshetri, N. (2018). 1 Blockchain's roles in meeting key supply chain management objectives. *International Journal of Information Management, 39,* 80–89. https://doi.org/10.1016/j.ijinfomgt.2017.12.005

Mingxiao, D., Xiaofeng, M., Zhe, Z., Xiangwei, W., & Qijun, C. (2017). A review on consensus algorithm of blockchain. *2017 IEEE International Conference on Systems, Man, and Cybernetics (SMC)*, 2567-2572.

Nakamoto, S. (2008). Bitcoin: A peer-to-peer electronic cash system. Retrieved from https://bitcoin.org/bitcoin.pdf

Saberi, S., Kouhizadeh, M., Sarkis, J., & Shen, L. (2019). Blockchain technology and its relationships to sustainable supply chain management. *International Journal of Production Research, 57*(7), 2117–2135. https://doi.org/10.1080/00207543.2018.1533261

Nakamoto, S. (2008). Bitcoin: A peer-to-peer electronic cash system. Retrieved from https://bitcoin.org/bitcoin.pdf

Ningrum, D., Rizal, M., & Pratama, N. (2023). Proses Penyusuna Rencana Pengadaan Barang dan Jasa menggunakan Aplikais SMILE di PT Telekomunikasi Indonesia Tbk. JOMBLO: Jurnal Organisasi dan Manajemen Bisnis Logistik, 1(1), 64-86.

Pilkington, M. (2016). Blockchain technology: principles and applications. In *Research handbook on digital transformations* (pp. 225-253). Edward Elgar Publishing.

Queiroz, M. M., & Wamba, S. F. (2019). Blockchain adoption challenges in supply chain: An empirical investigation of the main drivers in India and the USA. *International Journal of Information Management, 46*, 70-82. https://doi.org/10.1016/j.ijinfomgt.2018.11.021

Telkom Indonesia, 2015. SMILE (Supply Management Information for LogisticsEnhancement, Internal document.

Tapscott, D., & Tapscott, A. (2016). Blockchain revolution: How the technology behind bitcoin is changing money, business, and the world. *Penguin Random House*

Saberi, S., Kouhizadeh, M., Sarkis, J., & Shen, L. (2019). Blockchain technology and its relationships to sustainable supply chain management. *International Journal of Production Research, 57*(7), 2117–2135. https://doi.org/10.1080/00207543.2018.1533261

Sedlmeir, J., Buhl, H. U., Fridgen, G., & Keller, R. (2020). The energy consumption of blockchain technology: Beyond myth. *Business & Information Systems Engineering, 62*(6), 599-608

Swan, M. (2015). Blockchain: Blueprint for a new economy. *O'Reilly Media.*

Pilkington, M. (2016). Blockchain technology: principles and applications. In *Research handbook on digital transformations* (pp. 225-253). Edward Elgar Publishing.

Valinejad, F., & Rahmani, D. (2018). Sustainability risk management in the supply chain of telecommunication companies: A case study. Journal of Cleaner Production, 203, 53-67.

Xu, X., Weber, I., & Staples, M. (2019). Smart contracts: Bridging the gap between blockchain and enterprise applications. *IEEE Transactions on Engineering Management, 67*(4), 1045-1058.

Zheng, Z., Xie, S., Dai, H., Chen, X., & Wang, H. (2018). An overview of blockchain technology: Architecture, consensus, and future trends. *2017 IEEE International Congress on Big Data (BigData Congress)*, 557-564.