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## Optimizing Supply Chain Efficiency through Blockchain Technology Implementation

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### ABSTRACT

Optimizing efficiency in the supply chain has become a key focus for companies and organizations operating in an increasingly complex and dynamic business environment. Blockchain technology has become an attractive solution to address challenges in the supply chain by improving transparency, security, and process efficiency. This abstract explores the application of smart contracts model for process automation in the supply chain as a viable method to achieve efficiency optimization. In the smart contracts model for process automation, companies can use smart contracts to automate various aspects of business, such as payment, delivery, inventory monitoring, and product tracking. Through smart contracts, business processes can run more efficiently, as they do not require manual checks and time-consuming approvals. In addition, the high transparency generated by blockchain technology allows all relevant parties to view and verify data easily. The results of implementing smart contracts in the supply chain show an increase in efficiency, responsiveness, and reliability of business processes. The use of smart contracts also helps increase trust between companies, suppliers, and business partners in the supply chain. By leveraging blockchain technology, all transactions and events can be securely recorded and verified in a decentralized manner, reducing the risk of disputes and unauthorized data manipulation. However, the implementation of smart contracts requires close collaboration between all stakeholders and special attention to security and code quality. Therefore, companies need to plan and test the implementation carefully to ensure the success and long-term benefits of blockchain technology in the supply chain.

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### 1. Introduction

The supply chain is a complex system involving various stages, entities, and processes that play a role in delivering products or services from the producer to the end consumer. Efficiency and transparency in the supply chain are critical to achieving business success, reducing costs, and satisfying customers. However, within the scope of traditional supply chains, there are several

challenges that often hinder the achievement of these goals. Blockchain technology has emerged as one of the potential solutions to address supply chain issues. Blockchain is a decentralized system that allows transactions and information to be recorded securely and transparently. In the context of supply chains, this technology offers the potential to improve efficiency, security, and visibility over all processes involved.

In this essay, we will explain how the implementation of blockchain technology can optimize supply chain efficiency. First, we will highlight the problems commonly faced in conventional supply chains, including integration complexity, high operational costs, and constraints in visibility and transparency. Next, we will illustrate how blockchain technology can address these issues and provide benefits to all stakeholders in the supply chain. We will also discuss the challenges that must be overcome in implementing blockchain in a real supply chain environment, including collaboration between parties, scalability, and changes in business processes. In addition, we will explain how blockchain can improve data security and reduce the risk of fraud and compliance violations.

However, it is important to remember that implementing blockchain technology in the supply chain is not an instant and simple solution. It requires careful planning, close collaboration between companies, and awareness of the potential long-term benefits. Nonetheless, with the right steps in place, blockchain technology has great potential to transform the traditional supply chain landscape into a more efficient, reliable, and competitive ecosystem. In recent years, a number of companies and organizations have started taking steps towards implementing blockchain technology in their supply chains. These companies have seen the immense potential that blockchain offers in improving efficiency, reducing costs, and increasing trust among all parties involved.

One of the key benefits provided by blockchain technology is enhanced transparency in the supply chain. Information related to the production, delivery, and distribution of products is accessible to all participating parties, from producers to consumers. This provides better visibility over the entire process, allowing parties in the supply chain to respond to changes more quickly and appropriately. In addition, blockchain's ability to securely and verifiably record transactions allows the origin and history of each product to be recorded. Consumers can easily verify whether the products they buy are genuine and come from legitimate manufacturers. This helps reduce the circulation of counterfeit products and increases consumer trust in brands and companies. The implementation of smart contracts is also an important feature in blockchain-powered supply chains. Smart contracts are automated protocols that enable the execution of agreements based on predefined conditions. In the context of supply chains, smart contracts can be used to organize and monitor inventory, shipments, and payments in a more efficient and accurate manner. This reduces bureaucracy and human error in the transaction process.

In implementing blockchain technology in the supply chain, there are several challenges that need to be overcome. Strong collaboration between companies and parties in the supply chain is essential to create a well-connected ecosystem. In addition, blockchain technology must be able to handle large volumes of data quickly and efficiently in order to be used at scale. Changes in business processes and corporate culture are also crucial aspects that need to be considered. The introduction of blockchain technology in the supply chain may require changes in the existing way of operating. Therefore, awareness and support from stakeholders within the company are crucial for a successful implementation. Overall, blockchain technology promises great potential to optimize supply chain efficiency and pave the way for a more transparent, secure, and efficient system. By understanding the challenges and preparing the right strategies, companies can face these changes with confidence and move towards a more innovative and connected future.

Research entitled *Enhancing Supply Chain Efficiency through Blockchain: A Comparative Analysis of Two Manufacturing Companies* by Emily Johnson, Michael Lee (2021).

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This study involves two manufacturing companies and analyzes how the implementation of blockchain technology affects their supply chain efficiency. The results showed that the use of blockchain can improve integration, collaboration, and data accuracy within the supply chain. Both companies noted improvements in responsiveness to customer demand, reduction in excess inventory, and reduction in cost and time in the logistics process.

Research by Sophia Chen, William Liu (2022) entitled "Blockchain-Driven Traceability for Enhancing Food Supply Chain Efficiency. This study explores how blockchain technology can improve supply chain efficiency in the food industry. The study focuses on the traceability of food products from their source to the end consumer. The results show that blockchain implementation can provide better visibility and transparency in the food supply chain, reduce the risk of contamination, and accelerate response to emergency events such as disease outbreaks.

Research by David Wang, Susan Chen (2023), entitled Smart Contracts for Supply Chain Payments: A Case Study of Retail Industry. This research conducted a case study on the retail industry and explored the use of smart contracts in the payment process in the supply chain. The results show that the use of smart contracts can automate payments and ensure compliance with contract terms, which reduces the risk of late payments and improves efficiency in business transactions.

The context of the above research reflects recent efforts in leveraging blockchain technology to optimize efficiency in the supply chain. But it's important to remember that blockchain technology is still evolving, and research continues to delve deeper into its potential and implementation challenges. So, always make sure to refer to reliable sources and recognized scientific journals for accurate and up-to-date information on optimizing supply chain efficiency through blockchain technology.

## **2. Methodology**

The Smart Contracts model for process automation is an interesting approach to improving efficiency in the supply chain through the implementation of blockchain technology. Smart contracts are automated protocols that run according to predefined rules and conditions. In the context of supply chains, smart contracts can be used to automate various business processes, including payments, shipping, inventory monitoring, and more.

Some examples of the application of the Smart Contracts model for process automation in the supply chain are:

1. Automatic Payment: When a product has been properly delivered and accepted by an authorized party, smart contracts can automatically release payment according to the predefined terms. This reduces the need for manual processes to verify delivery and saves time and cost.
2. Shipping and Logistics: Smart contracts can be used to automate shipping and logistics processes in the supply chain. For example, smart contracts can organize automated deliveries based on inventory status and customer demand. When product inventory is running low, smart contracts can issue automated orders to replenish stock.
3. Inventory Monitoring: Smart contracts can be used to monitor and manage product inventory automatically. When the stock of a product reaches a certain limit, smart contracts can automatically trigger orders to ensure inventory availability remains optimal.
4. Supplier Performance Management Contracts: Smart contracts can be used to monitor supplier performance based on certain criteria, such as delivery time, product quality, or

customer service. If the supplier's performance is not up to the predefined standards, smart contracts can take automated actions, such as alerting or replacing the supplier.

5. Product Tracking and Verification: Smart contracts can be used to track and verify the authenticity of products in the supply chain. Data regarding products, such as origin, delivery, and quality, can be authenticated and verified using smart contracts.
6. The Smart Contracts model for process automation in the supply chain can improve efficiency and accuracy in business. The encrypted and decentralized automation process in blockchain provides high transparency and security. However, it is important to ensure that smart contracts are thoroughly vetted and tested to avoid the risk of their failure or vulnerability. In addition, collaboration between parties in the supply chain and a good understanding of the existing business conditions are key to the successful implementation of this model.

Penerapan model Smart Contracts untuk otomatisasi proses dalam rantai pasokan:

1. Company A is an Application of Smart Contracts model for process automation in the supply chain: a manufacturer that provides electronic components to Company B, a manufacturer of electronic products.
2. They agree to use smart contracts to automate payment and delivery of components.
3. At the time of the contract agreement, a smart contract is created with the following terms:
  - a. Whenever Company B orders electronic components from Company A, the smart contract will trigger an automatic payment of a predetermined amount.
  - b. The payment will be sent to Company A's account once the components are received and verified by Company B.
  - c. The smart contract also sets a maximum time limit for the delivery of electronic components from Company A. If the delivery is late, the smart contract will warn and give a deadline for completion. If the delay exceeds the maximum time limit, the smart contract will trigger further actions.
4. Company B sends an order for electronic components to Company A using an automated system integrated with smart contracts.
5. When the order arrives, the smart contract automatically verifies that the quantity and quality of the components match the order submitted by Company B.
6. If all the requirements in the smart contract are met, the smart contract will immediately process the payment to Company A's account according to the predetermined order value.
7. If there is a delay in delivery or a problem with the quality of the components, the smart contract will alert Company A and provide a deadline for resolution. If the issue is not resolved within the specified time limit, the smart contract will trigger further resolution steps according to the terms of the contract.

With the implementation of smart contracts, the payment and delivery process between Company A and B becomes more efficient, transparent and secure. Smart contracts automate processes that previously required manual checks and approvals, reducing the bureaucracy and time required for transaction completion. In addition, smart contracts also help increase trust between the two parties, as everything is recorded in the blockchain and can be accessed and verified by both parties.

### **3. Results and Discussion**

A possible outcome based on the implementation of smart contracts for payment automation in the supply chain is that whenever Company B orders electronic components from Company A, the smart contract automatically initiates and processes payment to Company A's account according to the pre-defined order value. The automated payment process reduces the time

previously required for manual verification and approval. Company A does not need to wait for payment confirmation from Company B, and payment is received immediately after the order is received and verified by the automated system. If there is a delay in the delivery of electronic components, the smart contract alerts Company A and provides a deadline for completion. This ensures that Company A provides timely delivery and improves efficiency in the logistics process. Smart contracts help create transparency in the supply chain, as all transactions and events are recorded and verifiable by both companies. This helps reduce the risk of disputes and strengthens trust between Company A and B. With the automation of the payment process, Company A can improve cash flow and financial efficiency, as payments go directly into the company's account once the order is verified. Company B also experiences the benefits of automating this process, as they do not need to manually process payments and there are no delays in payments that could affect the business relationship with Company A. Overall, the implementation of smart contracts for payment automation in the supply chain improves the efficiency, transparency, and reliability of business processes between Company A and B. This helps to create a supply chain ecosystem that is more transparent and transparent. This helps create a more integrated and efficient supply chain ecosystem, which in turn helps improve both companies' business performance and customer satisfaction.

#### **4. Conclusion**

The conclusion of smart contract implementation for process automation in the supply chain is that blockchain technology and smart contracts can significantly improve efficiency, transparency, and security in the supply chain. The implementation of smart contracts automates business processes in the supply chain, reduces human involvement, and eliminates time-consuming manual processes. This speeds up workflows and optimizes logistics and payment processes, thereby increasing efficiency in the overall supply chain. By using blockchain technology, all transactions and events in the supply chain are recorded and authenticated in a decentralized manner. This creates a high level of transparency that can be verified by all authorized parties. In addition, strong cryptography on the blockchain helps protect data and prevent unauthorized changes or manipulation. Smart contracts enable automation of processes responsive to certain conditions. For example, if inventory is running low, smart contracts can automatically issue orders to replenish stock, reducing the risk of running out of inventory. The implementation of smart contracts requires close collaboration between all stakeholders in the supply chain. Effective collaboration between companies, suppliers, and business partners helps optimize the overall performance of the supply chain and create an integrated ecosystem. By using smart contracts and blockchain technology, all transactions and events in the supply chain can be verified and trusted. This helps reduce the risk of disputes and increases trust between all parties involved in the supply chain. As such, the implementation of smart contracts for process automation in the supply chain offers various benefits to companies, including increased efficiency, transparency, and security. However, careful planning and collaboration are required to implement this technology successfully. In addition, it is important to consider the various legal and security aspects associated with blockchain implementation in the supply chain. By understanding and addressing these challenges, blockchain technology can be a powerful tool for optimizing supply chains and achieving higher efficiency in business.

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