A Smarter Way to Procure: Exploring the Use of Smart Contracts

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Abstract: Purpose:This article delves into the transformative potential of smart contracts in revolutionizing procurement within supply chain management, with a special focus on the healthcare industry. In line with the challenges posed by complex procurement processes, the study explores how self-executing digital contracts can enhance efficiency, security, and transparency.

Theoretical framework:The article is grounded in the concept of smart contracts and their applications in procurement, serving as a bridge between emerging technology and supply chain management innovation. It draws upon an extensive body of literature and research related to smart contracts, supply chain management, and technology adoption. The study is designed to build upon this theoretical foundation, using two comprehensive case studies to provide real-world insights and practical applications. These case studies, situated within the healthcare industry, serve as tangible examples of how the theoretical concepts surrounding smart contracts manifest in actual procurement processes.

Design/methodology/approach:To investigate the application of smart contracts in healthcare procurement, we employed a qualitative research approach. This encompassed an extensive literature review of academic papers, industry reports, and relevant articles, uncovering the unique advantages and challenges in procurement & supply chain management. Building upon these findings, we developed a groundbreaking smart contract-based procurement system, presented through sequence diagrams. To validate our solution, we implemented and rigorously tested it within a real-world Ethereum environment.

Findings:Our research reveals that integrating smart contracts into procurement processes results in streamlined operations, diminished reliance on intermediaries, and heightened transparency and traceability. Moreover, the proposed solution showcases significant potential for enhancing procurement efficiency in the healthcare sector.

Research, Practical & Social Implications:

These findings present valuable insights with far-reaching implications and hold substantial implications for stakeholders. Healthcare organizations can harness smart contracts to optimize their procurement procedures, yielding improved efficiency, transparency, and security. In a rapidly digitalizing landscape, our research empowers companies to maintain their competitive edge while delivering enhanced value to partners and customers.

Originality/value:This article contributes significantly to the existing literature by offering a comprehensive examination of smart contract integration within procurement function, set within the broader context of supply chain management. It introduces a pioneering solution and provides a validated methodology, paving the way for in-depth exploration of smart contracts' impact on diverse stakeholders across healthcare supply chains.

Keywords: Smart Contract (SC), Digitalization, Procurement, Supply chain management, Healthcare sector

1. INTRODUCTION

Smart contracts are digital agreements that run automatically when certain conditions are met. These contracts have become quite popular because of their ability to simplify transactions, increase transparency, and reduce spending. The procurement function, which involves a company's acquisition of goods and services, is one area where smart contracts can be valuable. Smart contracts can minimize the need for intermediaries, increase efficiency, and reduce the risk of fraud by automating the procurement process.

The purpose of this article is to investigate the use of smart contracts in procurement. It will particularly review the existing literature on the subject and identify the benefits as well as the drawbacks of using smart contracts in

procurement processes. As a result, this article will provide insights into how companies can use smart contracts to continue improving their procurement processes and generate more value for their stakeholders.

Organizations must embrace new technologies as the world becomes more and more digital in order to remain competitive. By implementing smart contracts in their procurement processes Organizations can

gain from increased efficiency, transparency, and security, which will ultimately increase value for their partners and customers.

2. LITERATURE REVIEW

Procurement processes are crucial for companies to acquire the goods and services they require to run their businesses. These processes, even so, are frequently complicated, time-consuming, and susceptible to mistakes and fraud. Smart contracts, which are self-executing digital contracts that optimize the execution of contract terms, are emerging as a promising solution for improving the efficiency and security of procurement processes. This literature study, based on relevant scientific publications, offers a summary of current research regarding the application of smart contracts in procurement.

2.1 Benefits of smart contracts:

Several studies have found numerous advantages to using smart contracts in procurement. One significant advantage is their ability to eliminate the need for intermediaries such as lawyers and brokers, saving both time and money. Smart contracts can indeed improve transaction speed as well as precision by streamlining contract execution, lowering the possibility of errors and misinterpretations. Moreover, they can provide real-time tracking of procurement activities, increasing accountability and transparency (Biswas et al., 2019; Hapke et al., 2018; Kshetri, 2018; Mengelkamp et al., 2018).

In Addition, Roth and Fazli (2020) conducted a systematic review on smart contracts in supply chain management and identified benefits such as automation, transparency, and security. They also emphasized the possibility of cost savings and shorter lead times. Singh et al. (2019) introduced a blockchain-based framework for secure and efficient supply chain management smart contracts. They shown how the suggested system could promote efficiency, lower costs, and increase trust among parties.

2.2 Challenges & Limitations:

Smart contracts in procurement may have some advantages, but there are also some issues that need to be resolved. For instance, Mengelkamp et al. (2018) carried out a thorough analysis of blockchain in the energy sector and found difficulties with scalability, interoperability, and legal concerns. Similar difficulties were noted by Roth and Fazli (2020), including the need for standardization and the difficulty of implementing smart contracts.

Also, using smart contracts necessitates the use of standard contract templates, which can reduce the amount of flexibility in contract terms. Furthermore, there may be inconsistencies between smart contract terms and laws, particularly in areas like data privacy and intellectual property (AlHares et al., 2020; Iansiti & Lakhani, 2017).

2.3 Applications:

On the use of smart contracts in procurement, several case studies have been carried out, offering insights into their real-world applications. In one case study, smart contracts were used to automate the purchase of office supplies, resulting in a 30% cost reduction and a notable increase in transaction speed (Biswas et al., 2019). Another case study looked at the application of smart contracts to the purchase of building materials, highlighting the potential for increased accountability and transparency in supply chain management (Hapke et al., 2018).

There are many procurement-related applications for smart contracts, including e-procurement, supply chain management, traceability, collaborative procurement, and auctions. These tools can boost productivity, lessen mistakes, and increase communication and trust among stakeholders. More applications are initially expected to emerge as smart contract technology develops, further altering the procurement landscape.

- **E-procurement:** E-procurement systems may be rendered more effective and transparent by using smart contracts. For instance, A system based on a smart contract that automates the procurement process, from the creation of purchase orders to the payment of invoices, was proposed by Sood and Sharma (2019) for small and medium-sized enterprises (SMEs). According to the authors, the suggested system might boost customer trust, increase efficiency, and decrease transaction costs for SMEs.
- **Supply chain management:** Numerous articles demonstrated that smart contracts are very important for the supply chain performance. Wang and Liao (2019) proposed a healthcare supply chain management system based on smart contract that could automates the supply chain process, from drug and medical device manufacturing to distribution and sale.
- **Traceability:** Smart contracts can be used to provide traceability and enhance food safety. Yu et al. (2019) proposed a smart contract-based traceability system for food safety that could improve the traceability of food products and reduce the risk of foodborne illnesses.
- **Collaborative procurement:** Zhang et al. (2020) proposed a smart contract-based collaborative procurement system. The proposed system could reduce transaction costs, enhance trust between parties, and improve the efficiency of the procurement process.
- **Auctions:** Chen et al. (2018) proposed a smart contract-based auction system that reduces transaction costs, prevents bid-rigging, and improves the efficiency of the bidding process

3. METHODOLOGY

This article presents a research study aimed at exploring the potential of smart contracts in the procurement function of supply chain management. The study followed a qualitative research approach that involved a thorough literature review of relevant articles, academic papers, and industry reports. The review focused on identifying the advantages, challenges, and current applications of smart contracts in supply chain management. The findings of the literature review were used to develop a proposed solution for a smart contract-based procurement system that addresses the identified challenges and leverages the benefits of smart contracts. The proposed solution was captured in the form of a series of functions and events in sequence diagrams. To validate the proposed solution, an Ethereum test environment was used to implement the solution and test its functionality. The proposed solution aims to enhance transparency, traceability, and efficiency in the procurement function of the supply chain by using smart contracts. The study concludes with suggestions for future research to explore the potential of smart contracts in supply chain management and their impact on different stakeholders.

1. Case studies: Application of smart contracts in healthcare industry

In smart contracts, the terms of the agreement between the buyer and seller are directly written into lines of code. These contracts self-execute. Smart contracts enable the automation of some processes and operations as well as the direct verification and enforcement of contracts.

Smart contracts can be used in the healthcare industry to automate a number of procedures, including clinical trials, medical record management, and claims processing. Additionally, they can be used to guarantee legal compliance, lessen fraud and abuse, and enhance patient outcomes.

4.1 Case Study 1: Clinical Trials

Clinical trials are a necessary part of the process of creating new drugs, but they are oftenly pricy, time- consuming, and require a lot of paperwork. Smart contracts can be used to accelerate, reduce cost, and improve the effectiveness of clinical trials. By automating many of the procedures involved in clinical trials, such as patient recruitment, consent management, and data collection, smart contracts can help improve the quality and accuracy of clinical trial data and lead to better patient outcomes.

One of the biggest benefits of using smart contracts in clinical trials is automating the consent process. Informed consent is a critical step in the clinical trial process that ensures patients are aware of the benefits and risks of participating. Smart contracts can be programmed to ensure that patients have access to all necessary information before giving their consent. Using smart contracts for consent management can also help to reduce the risk of

misunderstandings or errors because the contract can be created to ensure that all necessary documentation is completed and recorded.

Another advantage of using smart contracts in clinical trials is the automation of data management and collection. Smart contracts can be programmed to gather data directly from patients and healthcare providers, reducing the need for manual data entry and eliminating the possibility of errors. Smart contracts can be used for data collection and management in clinical trial studies to improve the accuracy and dependability of the data. Better patient outcomes and more efficient treatments will follow from this.

Overall, the use of smart contracts in clinical trials has the potential to revolutionize the way drugs are developed by enabling more dependable, effective, and affordable clinical trials.

The use of smart contracts in healthcare offers numerous benefits, including improved efficiency, reduced fraud and abuse, better patient outcomes, and increased transparency :

- **Improved efficiency:** By automating many of the processes involved in healthcare, such as claims processing, medical record management, and clinical trials, smart contracts can help to improve efficiency and reduce costs.
- **Reduced fraud and abuse:** Smart contracts can be programmed to detect and prevent fraud and abuse, reducing the risk of improper payments and other unethical behavior.
- **Better patient outcomes:** Smart contracts can be used to automate the collection and analysis of patient data, leading to more personalized treatment plans and better patient outcomes.
- **Increased transparency:** Smart contracts can provide greater transparency into healthcare transactions and processes, reducing the risk of errors and improving trust between parties.

With the increasing complexity of clinical research, we designed novel smart contract code for the management of clinical trials to enhance transparency, traceability, and compliance in the conduct of trials. The proposed smart contract code creates an immutable, decentralized, and secure platform for all trial stakeholders, including buyers, sellers, investigators, and participants. We eliminate the need for traditional intermediaries by leveraging blockchain echnology, resulting in a more efficient and cost- effective way to manage clinical trials. Our solution ensures that all trial activities are carried out in accordance with pre-specified protocols, while sensitive data remains confidential. The smart contract code below represents a significant advancement in clinical trial management, providing a transformative solution that can benefit the entire healthcare sector:

```
contract SupplyChain {
    enum Status { Created, InProgress, Completed, Cancelled }
    struct Contract {
        uint256 id;
        address supplier;
        address buyer;
        uint256 amount;
        Status status;
        uint256 createdDate;
        uint256 dueDate;
        uint256 completedDate;
    }
    uint256 public contractCount;
    mapping(uint256 => Contract) public contracts;
    mapping(address => uint256[]) public supplierContracts;
    mapping(address => uint256[]) public buyerContracts;

    event ContractCreated(uint256 id, address supplier, address
buyer, uint256 amount, uint256 dueDate);
    event ContractUpdated(uint256 id, Status status, uint256
completedDate);

    function createContract(address _supplier, address _buyer,
uint256 _amount, uint256 _dueDate) public {
        require(_supplier != address(0), "Invalid supplier address");
        require(_buyer != address(0), "Invalid buyer address");
        require(_amount > 0, "Invalid amount");
        require(_dueDate > block.timestamp, "Invalid due date");
        Contract memory newContract = Contract(
            contractCount,
            _supplier,
            _buyer,
            _amount,
            Status.Created,
            block.timestamp,
            _dueDate,
            0
        );
        contracts[contractCount] = newContract;
        supplierContracts[_supplier].push(contractCount);
        buyerContracts[_buyer].push(contractCount);
        contractCount++;
        emit ContractCreated(newContract.id,
newContract.supplier, newContract.buyer, newContract.amount,
newContract.dueDate);
    }

    function updateContractStatus(uint256 _id, Status _status)
public {
        require(_id < contractCount, "Invalid contract ID");
        require(contracts[_id].status != Status.Cancelled, "Contract
already cancelled");
        require(contracts[_id].status != Status.Completed, "Contract
already completed");

        if (_status == Status.Completed) {
            require(msg.sender == contracts[_id].buyer, "Only buyer can complete the contract");
            contracts[_id].completedDate = block.timestamp;
        } else if (_status == Status.Cancelled) {
            require(msg.sender == contracts[_id].supplier || msg.sender == contracts[_id].buyer, "Only supplier or
buyer can cancel the contract");
        } else {
            require(msg.sender == contracts[_id].supplier, "Only supplier can update the contract status");
        }
        contracts[_id].status = _status;
        emit ContractUpdated(_id, _status, contracts[_id].completedDate);
    }
    function getSupplierContracts(address _supplier) public view returns (uint256[] memory) {
        return supplierContracts[_supplier];
    }
    function getBuyerContracts(address _buyer) public view returns (uint256[] memory) {
        return buyerContracts[_buyer];
    }
}
```

4.2 Case Study 2: Healthcare Supply Chain & Procurement

The healthcare sector is a complex and strictly regulated area that includes a number of stakeholders, including insurance providers, healthcare providers, patients, and regulatory bodies. Many processes and transactions in the healthcare sector could be automated with the help of smart contracts, which would reduce costs, boost productivity, and improve patient outcomes.

Numerous obstacles are faced in the healthcare industry, including:

- The introduction of new products and the elimination of obsolete products occurs at a rapid pace, as technological advances result in new treatment options each year.
- Imperfect forecasting methods and bad practices in ordering, purchasing, and distributing products all over the world also create obstacles.
- Health-care providers are having difficulty obtaining competitive prices for their products, particularly small providers.
- Health-care providers face additional challenges in managing personalized contracts, which necessitate extensive data analysis on supply, costs, usage models, competitor products, and pricing.
- Health-care providers are also struggling to manage medication shortages and find alternative products from other suppliers in the event that certain medical products are recalled for safety reasons.

The consequences of these shortcomings may include increased costs for health-care providers, poor management of the supply chain, and disruptions in the supply of medical products.

3.2.1 Actors of the health-care supply chain:

The various actors in the health-care supply chain include manufacturers of products or devices, group purchasing organizations (GPOs), distributors, and providers of health-care services such as hospitals, home-care agencies, retirement homes, and ambulatory care.

Each of these actors plays a critical role in the health-care supply chain and collaborates with the others to provide high-quality products and services to patients. The manufacturers create and sell medical equipment or pharmaceuticals, the GPO assists providers of services in obtaining more advantageous purchase prices by grouping purchases and negotiating sales prices with manufacturers, the distributors acquire products from manufacturers and sell them to providers of services, and providers of services provide quality care to patients by utilizing the products and equipment available.

3.2.2 Cost Analysis:

It is difficult to provide a precise estimate of the costs of managing the supply chain in the healthcare industry because it is dependent on numerous factors such as the size and type of business, the products and services provided, the regulation, and operational costs. However, there are studies and reports that provide a general picture of the costs associated with the health-care supply chain.

According to a 2017 study by the healthcare supply chain institution, the costs of the supply chain account for approximately 18% of total health expenditures, or nearly 450 billion dollars per year. Another 2018 Deloitte study found that supply chain costs accounted for approximately 35% of hospital operational costs in the United States.

The cost of the healthcare supply chain can vary widely depending on the specific products and services involved, as well as the region and market. However, a study by the Global Healthcare Exchange (GHX) found that the average hospital spent approximately $7.5 million on supply chain-related expenses in 2017. This includes expenses related to purchasing, inventory management, and logistics. Additionally, the GHX study found that supply chain inefficiencies cost hospitals an average of $9.9 million per year in lost revenue and increased operating expenses. These inefficiencies can result from a range of factors, including inaccurate inventory management, inefficient purchasing practices, and inconsistent supplier performance.

Moreover, another study published in the Journal of Healthcare Management found that supply chain management accounted for an average of 30% of a hospital's operating budget. The study also found that supply chain inefficiencies cost hospitals an average of $2.9 million per year, with 25% of those costs attributed to inventory management issues.

A report published by the Association for Healthcare Resource & Materials Management (AHRMM) found that supply chain costs account for an average of 45% of a hospital's operating expenses. The report also noted that supply chain inefficiencies can result in increased costs for labor, inventory, and purchasing.

Also, another study conducted by McKinsey & Company found that the use of digital technologies in the healthcare supply chain, including blockchain-based solutions, could result in cost savings of up to 25% for hospitals and healthcare systems. The study also noted that supply chain inefficiencies can result in increased costs for labor, inventory, and transportation.

In brief, these studies highlight the significant costs associated with healthcare supply chain management, as well as the potential for cost savings through the use of digital technologies like smart contracts.

3.2.3 Smart contract solution

A GPO contract is a purchasing agreement negotiated by a GPO (Global Purchasing Organization) with a supplier or manufacturer on behalf of its members. These contracts typically include pricing and terms for a range of products and services, such as medical devices, pharmaceuticals, and supplies. GPO contracts can help healthcare providers save money by providing access to lower prices and better terms than they might be able to negotiate on their own.

As result, the proposed solution is to implement GPO contract solution based on blockchain that connects manufacturers, distributors, GPOs, and health-care providers in a single decentralized Ethereum network. This solution makes use of blockchain technology to promote transparency, data origination, and data immutability in the contracting process. These parties interact with one another by utilizing the intelligent contracts depicted in the figure. Furthermore, we define the roles of each participating party and component of our solution:

- **Manufacturer**: a company that manufactures products or equipment and sells medical equipment or pharmaceuticals to healthcare providers.
- **Group Purchasing Organization (GPO)** : an organization that provides assistance to health-care providers such as hospitals, home-care agencies, retirement homes, and ambulatory care centers. They pool their purchasing power and use it to negotiate sales prices with manufacturers in order to obtain price reductions due to scale economies.As a result, suppliers prefer to work with GPOs because they have purchasing power and benefit from cost savings. The GPO does not acquire products; rather, they negotiate contracts for specific products with potential suppliers in the

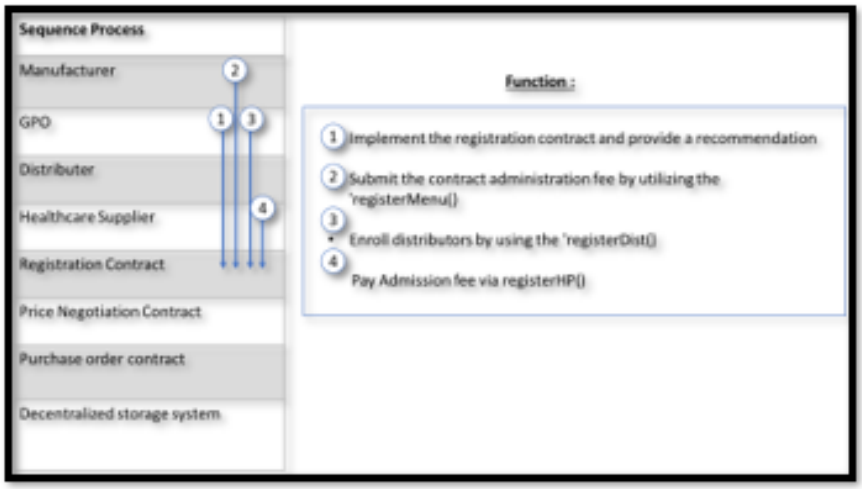
name of their suppliers based on the commitment that a minimum amount of purchase will be made by the suppliers during the contract's duration. Suppliers become members of the GPO by paying an annual cotisation, whereas manufacturers collaborate with the GPO by paying contract administration fees (CAF).

The CAF is a percentage of the total transaction value of the products purchased in the negotiated contract. As a result, the GPO's operating expenses are funded by the CAF and supplier cotisation. In exchange, the GPO generally rewards suppliers with a small percentage of the CAF in the form of loyalty rebates for future purchases.

- **Distributor:** A distributor is a middleman who buys products from manufacturers at a higher price and then sells them to health-care providers at the GPO contract price. The difference between the purchase price and the contract price is recovered by distributors through rebates to manufacturers. Normally, distributors conduct sales follow-ups in order to claim rebates, but with blockchain technology, this time-consuming process could be automated.

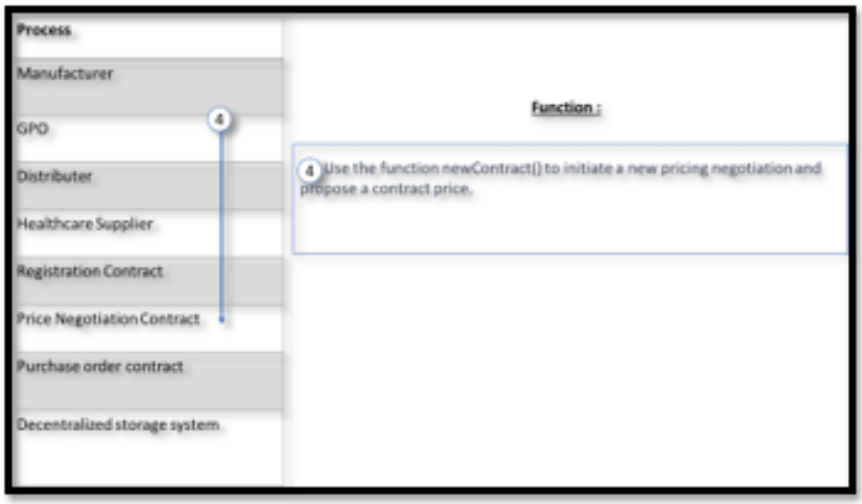
The historical data from all valid transactions would be permanently stored in the chain of blocks register, and manufacturers would no longer need to verify distributor claims about whether the product was sold at the agreed-upon price or not. Because of shipping costs and manufacturer rebates, distributors will increase their profit margin.

- **Health-care providers**: obtain products either through a GPO
- contract or directly from manufacturers, bypassing the GPO and the distributor. However, the passage indicates that the solution is focused on the first method, in which suppliers send purchase orders directly to the distributor using the contract price.



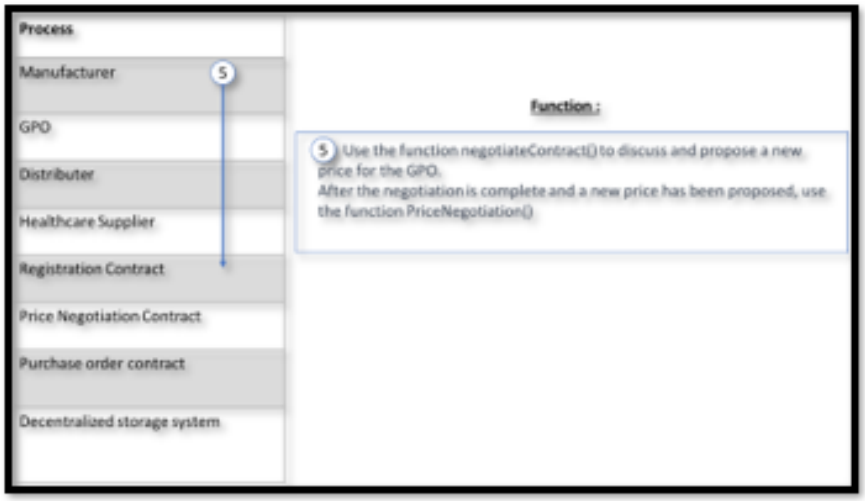
Event 1:

Notify stakeholders that the registration is successfully completed.



Event 2:

After the new contract has been proposed and published, use a notification system to inform all relevant stakeholders that the new contract is available.



Event 3:

Notify all relevant stakeholders of the new suggested price.

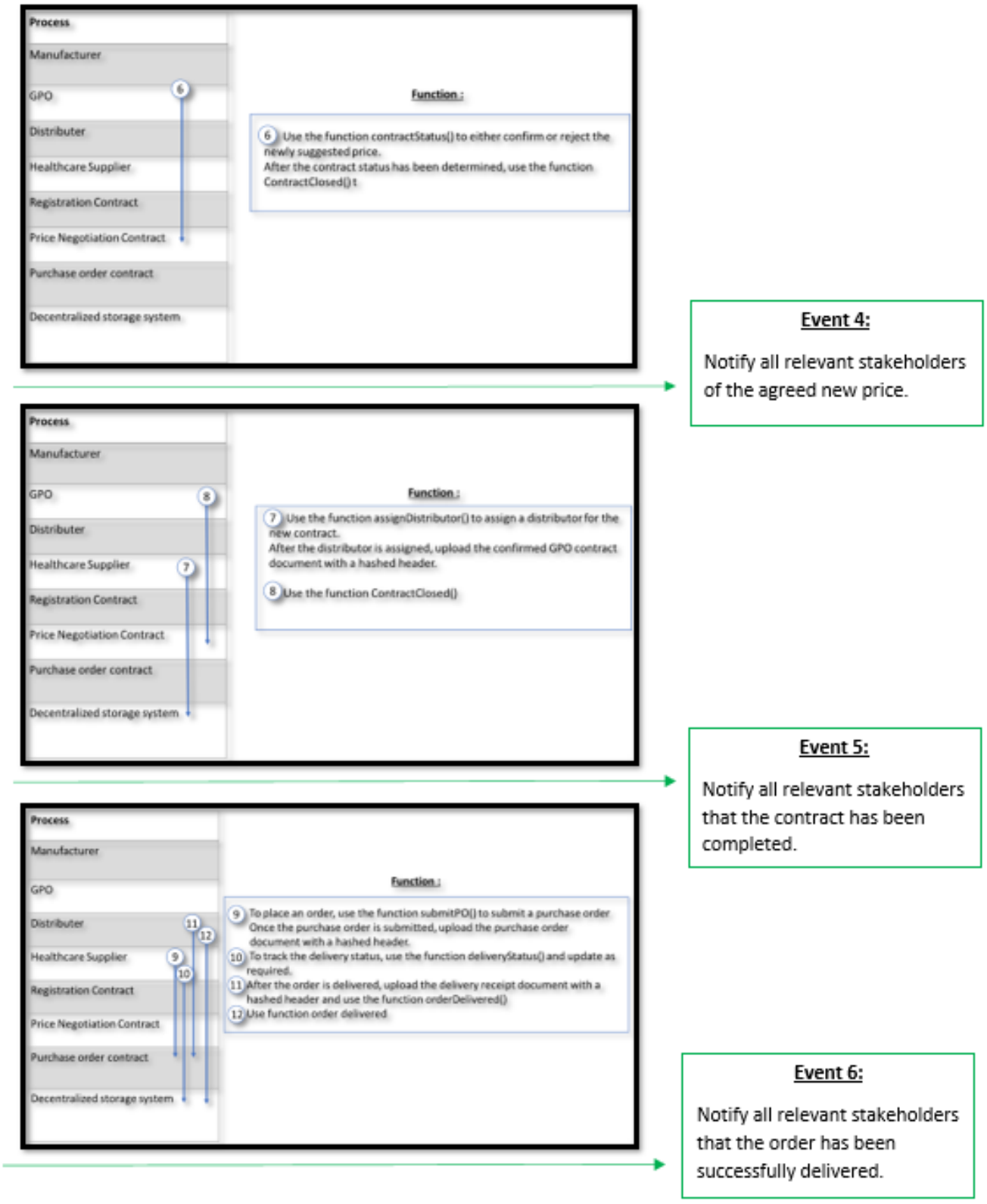


Figure 2: Proposed Smart Contracts Sequence

- **Interplanetary File System (IPFS**) - Interplanetary File System (IPFS): This is a pair-by-pair file system that allows you to connect the same file system to all network nodes. There are various file systems, such as IPFS and Filecoin. Authorized users have the ability to store large amounts of data in IPFS. Then, using cryptographic technology, immutable IPFS links can be created and stored in blockchain transactions as valid, time-stamped, and secure transactions. This is advantageous because the parties involved are not required to store a large amount of data in the blockchain itself. Thus, the combination of a distributed registry and a storage solution is appropriate for a GPO contract solution because only the indexable data would be stored on the chain, allowing the user to pinpoint exactly where the data is stored in IPFS.

— Ethereum Smart Contracts: Second-generation blockchain platforms, such as Ethereum, enable the creation of code in the form of intelligent contracts. These contracts can be programmed to perform functions automatically without the intervention of a third party. They act as software agents, ensuring that all network participants adhere to the terms and conditions outlined in the contract.

3.2.4 Proposed solution description:

The system is captured in the form of a series of functions and events in sequence diagrams that capture the interaction between each participating party and the contracts, as shown in figure 1. First and foremost, the system enables the GPO to execute the registration contract.

Each network participant is registered by entering their Ethereum address into the registration contract. The manufacturer and supplier confirm their registration by paying annual administration and membership fees, respectively, by calling the registerManuf() and registerHP() functions ().

The GPO then initiates a new price negotiation contract for a product or group of products by calling the function newContract at the name of the suppliers in the price negotiation contract. Using the PriceNegotiation function, the manufacturer negotiates the GPO's proposed price ().

The GPO approves or rejects the price proposed by the contractStatus function (). When a contract is confirmed, an event is triggered, notifying all parties involved in the network via the ContractConfirmed function (). The successful contract is then downloaded into the decentralized storage system and published for registered suppliers to purchase at a contract price. Furthermore, the GPO assigns a distributor between the manufacturer and the supplier to serve the contract via the assignDistributor function ().

The parties involved are then notified of the contract's success via the ContractClosed function ().The registered supplier is then authorized to place an order by calling the submitPO() function in the PurchaseOrder contract. The distributor fulfills the order while also providing the order status in the deliveryStatus function (). When a successful order is delivered, an event is triggered by using the orderDelivered function ().

Furthermore, the sequence diagram depicted in Figure 4 captures the rebate agreement between the manufacturer and the distributor once the order is successfully delivered under the RebateSettlement contract. The distributor submits a rebate request by calling the submitRebateRequest function (). The manufacturer then accepts the request and transfers the required amount via the approveRebateRequest function ().This causes an event to be triggered, informing all parties involved that the requested payment has been received by the distributor.

In addition, using the sendLoyaltyRebate() function, the GPO sends loyalty rebates to suppliers in exchange for contract fulfillment. This would trigger an event to notify suppliers that the amount has been successfully transferred by using the LoyaltyRebateTransferred() function.

3.2.5 Solution Implementation:

To put the proposed system into action, an Ethereum test environment was used. The IDE Remix was used for this purpose since it provides a testing environment for writing, deploying, and testing Ethereum smart contracts written in Solidity.

The overall view system mentioned in the section outlining the proposed solution has been implemented on the IDE Remix. The intelligent contracts were deployed on this IDE and then tested to ensure their functionality. The IDE

Remix handles the Solidity programming language for Ethereum smart contracts. The suggested solution makes the use of five intelligent contracts: intelligent contract of registration,

intelligent contract of price negotiation, intelligent contract of purchase, intelligent contract of discount resolution, and intelligent contract of loyalty discounts.

CONCLUSION

The use of smart contracts in supply chain management has been gaining attention due to their potential to enhance transparency, traceability, and efficiency in the process. Smart contracts offer several advantages over traditional contracts, such as automation of contract execution, real-time tracking, and secure data storage. They can also reduce the risk of fraud, errors, and disputes, which often occur in the complex supply chain environment.

Furthermore, smart contracts can enable parties to transact with each other directly, without the need for intermediaries, such as banks or lawyers. This can reduce transaction costs, improve speed, and enhance trust among parties. The use of blockchain technology, which underpins smart contracts, also adds an extra layer of security, making it difficult to tamper with the data.

However, there are some challenges associated with the implementation of smart contracts in supply chain management, such as the need for standardization of data formats, legal compliance, and the requirement for a robust and secure digital infrastructure. Additionally, the implementation of smart contracts may require changes to existing business processes and organizational structures.

Overall, smart contracts have the potential to revolutionize supply chain management and specially the procurement function, bringing greater efficiency, transparency, and trust to the process. As the technology evolves and the challenges are addressed, the adoption of smart contracts in supply chain management is expected to increase.

In this intriguing field, our findings are just a starting point for future research such as:

- Exploring the potential of smart contracts to facilitate the adoption of emerging technologies such as artificial intelligence, blockchain, and the Internet of Things in procurement.
- Investigating the ethical and social implications of smart contract-based procurement, including issues related to data privacy, security, and fairness.
- Developing innovative approaches and frameworks for designing and implementing smart contract-based procurement systems that meet the needs of different stakeholders.
- Analyzing the economic and financial aspects of smart contract-based procurement, including cost-benefit analysis, return on investment, and value creation.
- Studying the legal and regulatory frameworks that govern smart contracts in procurement and identifying the implications for different stakeholders.

Investigating the impact of smart contracts on supply chain management, including issues related to traceability, quality control, and logistics.

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