Analysis and Possibilities of Innovation of the Business Model Called Central Regulation Using Blockchain Technology

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ABSTRACT

Purpose: This paper clearly describes the possibilities of digitising a purchasing group's processes using blockchain technology. The main focus lies on its core business, financial service called central regulation and other services.

Methodology/Approach: After reviewing the literature, the most prominent blockchain projects in recent years in large companies were depicted to identify successful adoptions. The processes of purchasing group were described with the extension of innovative blockchain technology. A summary of potential advantages is presented in a table.

Findings: The conclusions could potentially be of a benefit to the management of purchasing groups as evidence suggests an increase in transparency in the whole process of the supply chain and, at the same time, bring effectiveness in payment processing. Combining permissioned and permissionless blockchain could be a viable solution for a purchasing group which uses a central payment system.

Research Limitation/Implication: The main limitation is the impossibility of testing the usage of blockchain technology in real-life conditions on a full scale. However, a sample of processes could be modelled further to test and develop the improvements and measure various parameters.

Originality/Value of paper: This approach is the first of its kind as there is no literature or publication on the usage of blockchain technology in the central regulation system. This paper can help with the decision-making process at the management level.

Category: Conceptual paper

Keywords: blockchain; central regulation; del credere provision; supply chain; digitalisation

1 INTRODUCTION

In a rapidly changing digital environment, small and medium-sized enterprises (SMEs) often have problems fighting big competitors. To stay successful in the market, they can join buying groups or purchasing associations whose primary role is to empower SMEs. In Western Europe, these associations often use a business model called in German "Zentralregulierung" (central regulation or central payment system), which has long history mainly in Germany and is based on payment settlement between contracted suppliers and buyers. The company which offers this kind of financial service guarantees payments to suppliers for all buyers, and for this guarantee, the Del Credere provision is paid by suppliers. As technological development advances, the business model must be adapted flexibly to this situation. Recent years show that blockchain technology is being used more frequently, and it has the potential to disrupt various sectors.

After describing the conceptual framework, possibilities of innovation of the central payment system using blockchain technology are presented as well as limitations and challenges which could pose a risk to the real-life application of this model. Finally, this paper offers an overview of how the whole procedure will change in both areas – financial services of central payment and blockchain technology used on all processes behind central payment – supply chain of goods and services. This is supposed to cut costs in payments infrastructure and speed up all transactions between users. Additionally, traceability of product provenance will push the whole supply chain to a completely next level.

2 LITERATURE REVIEW

The blockchain is a distributed ledger technology (DLT) in the form of a distributed transactional database secured by cryptography and governed by a consensus mechanism. A blockchain is essentially a record of digital events (Beck et al., 2017). There are already many fields where blockchain is being used, and many advantages will contribute to global economic growth. For example, according to PwC analyst report from October 2020, the global gross domestic product can increase by 1.76 trillion USD in the next ten years using blockchain technologies in various businesses (PwC, 2020).

The world is facing rapid development in the digital sphere within Industry 4.0, or the Internet of Things (IoT), where machines and things are networked via cyber-physical processes (Zimmermann, 2020). This phenomenon is spreading fast throughout the world, and according to the Ericsson mobility report published in 2018, cellular IoT connections grow annually by 30%. They estimate that in 2023, over 31.4 billion devices will be connected via IoT (Ericcson Mobility Report, 2021). The fourth industrial revolution refers to automation, digitisation of processes and increased production efficiency. Blockchain technology is often seen as a driver of this change, focusing on

artificial intelligence, cyber-physical systems, machine learning and IoT (Aoun et al., 2021).

Unique properties of blockchain offer unprecedented possibilities in corporate business. The necessity to rethink the traditional supply chain management arises from problems such as difficult logistics tracing, information and documentation flow or information asymmetry. The characteristics of blockchain technology bring entirely new possibilities, advantages and value-added potential for handling business processes, describing the status of products, exchanging information with stakeholders and new business models. Blockchain technology can transform existing business processes and significantly increase efficiency, reliability and security (Choo et al., 2020). Therefore, blockchain technology will increase massively in the coming years. Its use can generate certain economic benefits for companies and customers.

3   METHODOLOGY

In this paper, we focus on collecting and selecting relevant literature and appropriate information sources from previous studies, scientific articles and papers, which are presented in the literature review and description of frameworks. In part devoted to blockchain technology, we provide insights into various successful use cases in various areas such as supply chain and finance. Then, we describe the central regulation system as a business model used by purchasing associations, and we continue by incorporating blockchain into its infrastructure. After selecting the most crucial criteria, we carry out a comparison table to summarize the differences between the old and new innovative central regulation model. Finally, we point out some possible limitations of applied technology and propose further research opportunities.

4   FRAMEWORK OF BLOCKCHAIN SYSTEM AND ITS APPLICATIONS

Distributed ledger technology is understood as a system with multiple participants, which works without a central control authority despite the unknown reliability of these participants. According to (Yu et al., 2018), blockchain is an "append-only decentralised digital ledger based on cryptography".

Records cannot be modified or erased, and only new data can be added to the existing one. The peer-to-peer network enables each participating computer that owns a copy of the files to act as a client and a server for other participants in the blockchain network (Schmidgal, 2021). This endless chain of blocks with data enables traceability and the possibility to verify transactions at any time. (Mandolla et al., 2019). Depending on the configuration of blockchain, there are four common types of blockchain – public also known as permissionless

blockchains, private blockchains called permissioned blockchains, consortium blockchains or hybrid blockchains (Wegrzyn and Wang, 2021).

The first public one is mainly used in cases of cryptocurrencies, in digital identity projects, electronic voting or fundraising. A public blockchain is 100% decentralised and anybody is allowed to enter the network and interact with it by staying anonymous. However, suppose the company cannot allow sharing all information within the public network. In that case, it decides on a private blockchain, which is primarily used in banking, in the food industry or supply chain management. It is less decentralised than a public blockchain and not everybody can join or interact with this blockchain. Governance is in the hand of some central authority (organisation, government, or group of companies). Transactions are private, and fewer participants are allowed to validate transactions. This results in extremely fast verification of transactions and it requires less energy than a public permissionless blockchain. It is also more flexible and customisable. Another type of permissioned blockchain is consortium blockchain which is managed by a group of companies, not only by a single entity. It is more decentralised than a private one, which leads to more security. The last type of blockchain is a hybrid version of both public and private blockchain. A single authority controls this network, but it also has a public blockchain to validate some transactions. (Wegrzyn and Wang, 2021)

From previous research about blockchain technology, we can summarise the following features as the main characteristics of blockchain technology, which economic benefits can arise from: decentralisation, data management, resilience, cryptography, irreversibility, connectivity, digitisation, synchronicity, safety, non-falsifiability, transparency and traceability. (Dutta et al., 2020)

4.1 Successful Blockchain Applications

Although it is foreseen for SMEs to start exploring possibilities that the blockchain can offer evidence of successful applications is more visible in large companies. Blockchain integration is a cost-sensitive topic in SMEs, and a set of conditions must be met to achieve desired outcomes. Most importantly, it is a network effect, the presence of common goals of participants in the market and a need for trust and transparency among partners.

The most important fields of usage of DLT/ Blockchain are:

1.   Optimisation of contractual obligations

2.   Automation and optimisation of business processes

3.   Work with digital assets

4.   Digitalisation/tokenisation of assets

5.   Optimisation and automation of data storage

6.   Optimisation of supply chain

7.   Increase in the effectiveness of transactions

8.   Increase in business transparency

As such, blockchain is significantly more flexible with data than existing legacy digital systems as it provides almost real-time settlements of transactions.

4.2   Applications of Blockchain Technology in Corporations

Although some pioneer projects started in 2008, many projects of a more extensive scale were introduced in 2019. In the meantime, providers and consultant companies on blockchain technology emerged with leaders such as Amazon Web Services (AWS), IBM, Infosys and Wipro, followed by others, especially the Big4 consulting companies. (IDC, 2020)

If we look at successful applications of blockchain technologies, we can divide projects into categories: Supply chain, Finance and Documents transparency.

4.2.1   Supply Chain

The most common use of blockchain seems to be in the supply chain – transparent tracking of goods from raw materials to final product sales. When looking at Automotive industry, many corporations have already started pilot projects in this area, such as Tracking production process in Jaguar Land Rover (Ledger Insights, 2021), the PartChain project to trace parts and critical raw materials in BMW Group (2020) or more transparent and secure process of tracking raw material (Volkswagen AG, 2019). In food & beverages industry, the most active are Walmart, Nestle and Carrefour and companies like Anheuser-Busch with its subsidiary Budweiser (Castillo, 2019) and Peroni (Ernst & Young, 2021). TradeLens by IBM with Maersk includes over 100 logistic companies as a part of blockchain for shipments. Members are companies such as ports, sea and land carriers or customs agencies (IBM, 2018).

4.2.2   Finance

A great example of the usage of blockchain on a big scale is Singapore Stock Exchange which enabled trade settlement to be reduced by 60% (Amazon Web Services, 2020). Another evidence can be seen in Munich RE which tested, among other cost-saving effects of blockchain for insurance, specifically, automation in claims payments. Additionally, potential insurance fraud can also be avoided (Munich Re Life US, 2020). Allianz SE is selling flight-delay insurance based on blockchain connected to flight information, meaning that as soon as the information about delay/cancellation is obtained, the claim is initiated and the customer can get reimbursement much sooner (Allianz Travel Insurance, 2022).

4.2.3   Documents Flow and Transparency

VW Financial Services in 2021 started a blockchain project on E-signature and Digital Contracts bringing digital identity solutions with blockchain-verified e-signature. This solution is currently in use in the UK (Bloomberg, 2021). Big4 companies also advocate for blockchain, as it brings transparency into the documentation flow. For example, it would be much easier in the auditing process to check selected material invoices if they are part of the blockchain. Often, an expression digital asset is used to describe, e.g. invoice converted into a smart contract and integrated into the blockchain. Such digital assets can be relied on by investors, buyers or liquidators in the verification process (Thrill, 2018).

Many of the previously mentioned applications are evidence that buying associations, mostly famous within Germany will be forced in the near future to deal with this new technology in order to stay competitive and stay in the game. More and more industries will slowly start to require such blockchain connections from their suppliers.

5   FRAMEWORK OF CENTRAL REGULATION SYSTEM

The primary aim of improvement is to simplify financial settlements between contracted suppliers and members via purchasing association and ensure punctual payment of all invoices between these two parties. The contracted suppliers rely on safe and fast payments for all goods sold to all members, and for this service, suppliers are willing to pay the "del credere" provision as compensation for secured cash flow (Merriam-Webster.com, 2018). This helps suppliers plan better as the payment is guaranteed even in case of insolvency of a member. On the other side, there are members who pay for all their purchases from contracted suppliers to one central place – the association. For them there are other advantages, for instance, cumulated payments, possible longer payment terms and reduced transaction costs. If an association wants to settle payments via central regulation system, it is necessary to have a contract with a bank which is licensed to provide these services.
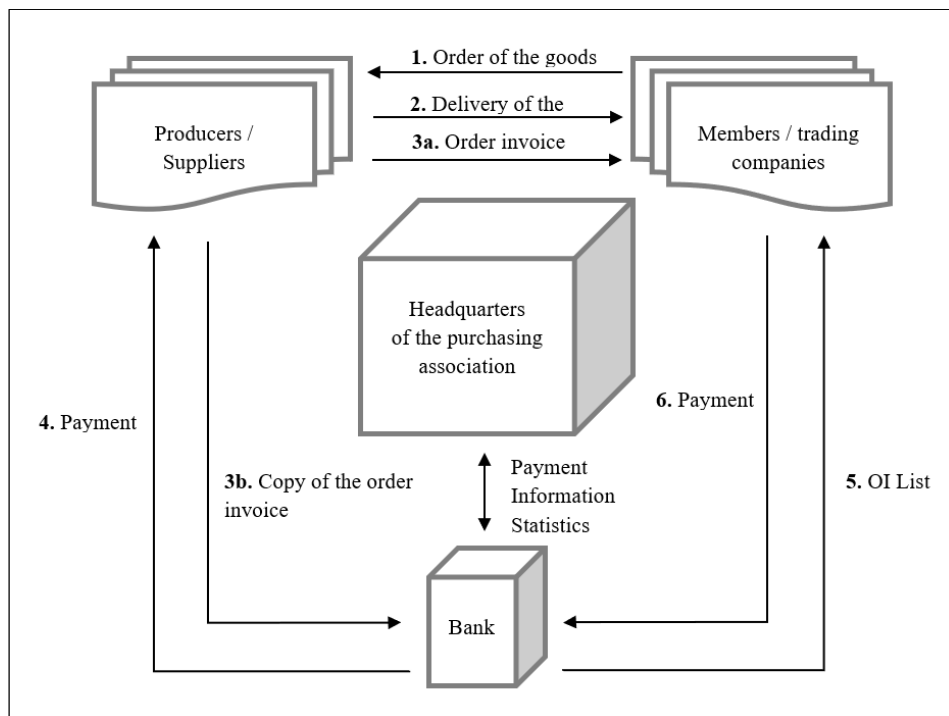
Figure 1 – Process of the Central Regulation System

The whole process of central regulation can be described in the following steps:

1. Trading company/member orders the goods directly from the supplier and receives order confirmation with price and estimated delivery date from the supplier.

2. Goods are delivered from supplier directly to member.

3a. When goods have been received, an invoice will be issued and sent directly from supplier to member (original invoice)

3b. In this step purchasing association steps into this process as the third party. Association (in particular the commissioning bank with bank licence for central payment) gets a copy of the invoice for central regulation from all suppliers.

4. Association pays suppliers for all members within agreed payment terms. The main advantage for the supplier is that association guarantees payments for all member companies. For this service association is charging del credere provision which is being deducted from the total amount stated on the invoice.

5. Open item list (OI List) will be issued for each member company once or twice a month. This OI List contains all cumulated invoices from all suppliers.

6. Money transfer from member to the association is done according to agreed payment terms just once or twice a month. The advantage for members arises from cumulated payments of all invoices in the given period of time instead of paying each of them separately. In total, it can significantly reduce administration costs, working time in the bookkeeping department and transaction costs.

6   ANALYSIS OF INNOVATION POSSIBILITIES OF CENTRAL REGULATION SYSTEM USING BLOCKCHAIN TECHNOLOGY

Since the central regulation system is managed by the association that connects suppliers and trading companies, a private blockchain will be applied because not all information can be public. Every invoice in the central regulation represents goods from the contracted supplier which the trading company then sells to the end customer. Even with electronic data interchange (EDI) solutions which enable digitally access and exchange of data of all transactions and products, it takes a long time and human resources from various departments to obtain complex information about the chosen case. This is ineffective and can be eliminated by implementing blockchain technology in this system.

Since every transaction between supplier, member company and association require gathering information about current price and availability, price negotiations and arrangements or contracts, there are always transaction costs involved in all these business processes. Moreover, opportunistic behaviour of all parties is present and focus on self-interest can lead to breach of contract. With blockchain, it is possible to transform these arrangements and contracts into smart contracts based on an algorithm. Then, action will be triggered automatically without human interaction only when a predefined condition is met. This can simplify the monitoring process which in the old model required much time.

We believe that advantages such as reduced operation time and transaction costs arising from the central regulation model using blockchain can incentivise each participant to behave according to the agreed terms and conditions, which can be saved in blockchain as smart contracts. Furthermore, innovation of this blockchain-based model will bring transparency to all participants and enable to optimise and speed up cooperation between companies by reducing manual work and operational processes.

The new model in Figure 2 is based on the assumption that all suppliers and members will participate on this permissioned blockchain where the association is the entity which decides who gets permission to join the network and interact with other participants.
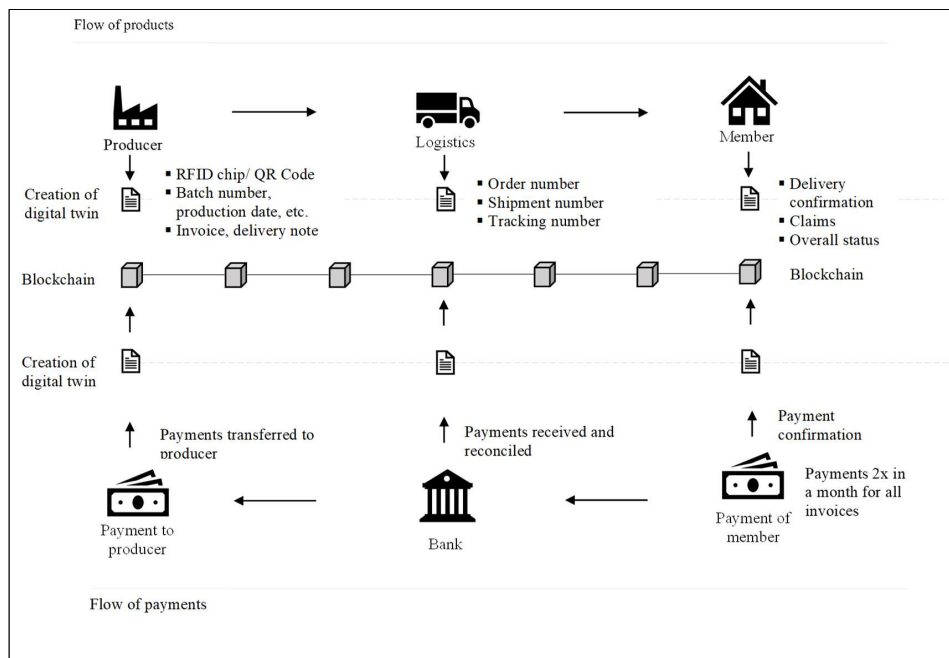
*Figure 2 – New Structure of Central Regulation Model Using
Blockchain Technology*

We see two flows within this model – product flow and payment flow. Some suppliers can be direct competitors and each of them has digital identity within the system. However, they cannot see information about other competitors and vice versa, so they can be sure that their information is private and secured and via smart contract visible only to members who demand the supplier's product.

Every participant is creating digital twin by recording all necessary data about product or payment. Before every block is mined, it has to be validated by all nodes within the blockchain. After this validation new block is added to the chain of blocks with reference to the previous block. Smart contracts are integrated into this structure in order to set up all necessary conditions between participants. All these contracts have predefined conditions, and an automated action will be triggered after validation. For instance, after receiving confirmation from the supplier about goods sent, the system will match this transaction with smart contract, which was already verified by the network and in the following step association will automatically pay the supplier according to the agreed payment terms with deduction of del credere provision for payment guarantee. All these transactions are recorded in an immutable and independent chain of blocks, and these data can be traced at any time. In case of malicious behaviour, the block will be caught because smart contracts react to this by detecting this fraud and the participant could be penalised.

Payments within the central regulation system will be executed automatically without human intervention when previously agreed terms are met. This leads to decreasing costs for the accounting department. Furthermore, payment terms are arranged separately between association and supplier and between association and the member company. Once these payment terms are implemented into smart contracts and verified by the network, nobody has to remember them and monitor them to pay in time because these due dates will be automatically identified.

Reduced physical contact via e-mails or phone may significantly change the whole purchase order management. Since everything can be traced reversely, nobody intends to compromise these certificates, ensuring transparency and security for members and suppliers. When the product is shifted to a logistics company and is sent to the member all information from the logistic company is also recorded in blockchain so that the supplier and member can track the delivery process. After the completed production and transaction cycle, customer satisfaction can be evaluated and recorded on blockchain.

Customer feedback on their products via blockchain enables continuous production process improvement. This feedback can be analysed and used for product development or adjustment. In the payment part, each payment behaviour is recorded and analysed in real-time. This helps to discover whether some companies tend to have financial problems and act very quickly to avoid insolvency cases of member companies.

This system will encourage producers to produce in their best quality, and finally, blockchain technology can improve profitability and performance in the industry. Additionally, authorities like tax and financial offices, auditing or insurance companies will encourage companies to implement blockchain technologies because it will simplify the correspondence and submission of documents and papers required for examination by these authorities. As a result, such a company could get a higher rating because of the transparency and security of all operations.

Furthermore, direct access to all statistics regarding manufacturing processes, logistics and sales can help associations, suppliers and members monitor the whole supply chain and continuously improve all procedures and transactions. Finally, this innovative model affects the whole value chain, which means that producers and associations have to think about the price of their products and services. Therefore, high investment costs on one side and reduced transaction costs will play a crucial role in the new pricing model.

Table 1 – Comparison of Chosen Parameters in the Old and New Innovated Model

Parameter	Old Central Payment Model	New Central Payment Model Using Permissioned Blockchain
System structure	• centralised system • a single entity or group of entities control the whole system (the group association via the bank) • they have full control over the whole procedure	• decentralised system • participants validate the whole system • smart contracts automatically execute actions when predefined conditions are met
Hardware	• system based on central web server, where all data are stored • proper backups are necessary to avoid data loss in case of a hardware crash • system crash causes loss of time and profit	• there is no single server which can crash and thus stop operational business • if some of the nodes or peer does not work properly, there are still many other nodes which can validate transactions on the network
Safety / Security	• the system can be hacked • the association works just with partners regularly monitored by the bank • payments are conducted via financial institution - bank (high security)	• only transactions validated by all required nodes will be made and recorded in the blockchain • transparent and secure payments • fraudulent behaviour automatically revealed – minimised risk of fraud
Trust issues	• centralised trust-based system • user has to trust the issuer • just the issuer can verify the process and the system • information asymmetry can be misused by issuer • user cannot verify if transactions are handled correctly • more possibilities for fraudulent behaviour	• decentralized / distributed trust-free system • every fraudulent behaviour can be detected, recorded and penalised - resulting in bad rating or end of coop. • additional trust is easily achieved in cooperation between more than two parties
Maturity of the model	• well known on the market for many decades • used mostly in German-speaking countries in the industry	• still in the developing process • new modern technology with some limitations which need to be clarified before implementation
Transparency	• transparency is achieved at some level, but in order to find something out or to make an analysis, it is necessary to gather data from more places within firms	• fewer misunderstandings • defined protocols rule all transactions • operations within smart contracts are transparent as confirmed by participants • retrieve statistics of revenues and sales for all transactions in a few seconds • effective communication with authorities, more accessible and faster auditing

Parameter	Old Central Payment Model	New Central Payment Model Using Permissioned Blockchain
Traceability	• possible, but very time-consuming • high costs and long waiting time to get the result (many people involved in this process) • data are isolated and fragmented	• suitable in industries with strict regulations about product provenance • in supply chain traceability is possible via digital twin of the product • possibility of real-time analysis of the status • goods can be tracked at every point of the supply chain
Contracts and Agreements	• arrangements and contracts are closed between partners in standard way • legal department archives these contracts in paper and digital form • monitoring requires manual work to determine whether participants' actions comply with contracts • time-consuming bureaucracy	• smart contracts are created within the network and actions are triggered automatically when predefined criteria are met, human intervention is not necessary • minimised bureaucracy • possibility to integrate multiparty agreements • automated execution of terms and conditions in every stage of supply chain with more participants - everything is tracked and recorded
Supply chain	• transparent only after corresponding between supplier, member and association • tracking of goods possible from shipping company - necessity to connect to the shipper's platform • tracing the product is more complicated and takes more time • human interaction can lead to errors • information asymmetry	• every stage of supply chain is recorded in blockchain • highly transparent • order management more efficient • real-time tracking of goods • enhanced supply chain • error elimination because of automated processes using smart contracts • reduction of physical documents • more consistent information
Payment	• manual work for bookkeeping department • delays in receiving documents can occur which can lead to late payments	• automated transactions using smart contracts - payment within agreed payment terms. • easy monitoring of payment flow

In the use cases mentioned in this paper, we can see evidence that the industry will require more and more possibilities to track product provenance during the product's complete lifecycle. In our innovative central regulation model, we can see the beginning of data blocks by the supplier who produces his products. In order to track products completely which will be demanded in future, we have to think one step further by involving pre-suppliers of raw materials in blockchain. This is, according to many experts, the future of businesses and the sooner the managers of associations realise the importance of this technology, the bigger and better competitive advantage they can achieve compared to competitors because until now there is no evidence in the market that such associations are planning to introduce this technology to their business model.

6.1 Limitations and Challenges

There are of course some limitations regarding this technology which need to be considered in decision-making about blockchain. The world is changing as rapidly as blockchain technology is being developed and there could be other technologies in the future to which blockchain can be vulnerable and not stable, such as supercomputers. Fast and reliable internet connection and enough space to download all data from the blockchain are also demanding components of this system. Furthermore, as the database grows exponentially, one limitation can be a storage space.

Another aspect is initial costs connected to this technology which in case of single SMEs could be nearly impossible to finance independently. On the other side, being a part/member of an association could be optimal for SMEs because of sharing costs between many members. Investment return will be significant before deciding about blockchain implementation.

Blockchain is often criticised for its immutability because recorded transactions cannot be changed. This can lead to the problem that if the information contains errors, this error cannot be corrected or adjusted. Furthermore, the regulatory and legal framework could be of severe other concern within using blockchain-based solutions within international companies since jurisdictions of various companies sitting in other countries can differ from each other.

7 CONCLUSIONS

Since industry will require more monitoring of supply chain, purchasing associations using central regulation model have to think about innovations in order to keep up with globalisation and digitisation. Modern technologies like blockchain are winning more attention and seem to be an appropriate tool to improve supply chain and transactions between supplier, association and member companies. After studying previous research, we proposed innovation of the central regulation model using blockchain technology with a clear objective – to speed up and optimise processes and thus reduce costs.

There is a tremendous interest of many companies in implementing blockchain in various fields and processes within organisations. This interest was even more accelerated by pandemics which triggered the transformation toward new modern technology. Investment costs connected to implementing such blockchain technology are very high when created internally. However, evidence shows that external providers of blockchain-as-a-service are gaining popularity on a global scale. When applied at a purchasing association, SMEs and suppliers participating in blockchain can benefit from shared costs. Blockchain-based solutions offer great conveniences to business organisations and open the door to an entirely new level of financial and supply chain management.

Process excellence and more efficient operations – one motivation to analyse possibilities of adopting this technology. Thanks to the digitisation of all operational processes, faster supply and payment management are expected, and this can lead to a higher volume of sales and payments thanks to automation. Some examples from various industries mentioned in this paper proved that a blockchain is a viable option, simultaneously achieving time effectiveness and transparency to the whole process.

This article is intended to serve as an indicator for managers of such associations to see a potential in implanting blockchain technology which is spreading very quickly. Some of the essential market participants are already using this technology to some extent and it is just a matter of time when the whole industry will switch to such solutions. SMEs as members of bigger associations should rely on these entities to help them survive in the modern digital world. Many predictions show where we are heading and blockchain-based solutions will be used daily in the future in many fields and industries. The primary motivation of this paper was to articulate an upgraded central payment model by blockchain technology based on successful blockchain applications in important international corporations. As complete transition could be discouraging initially, corporations could simultaneously start a trial with the parallel solution – using blockchain and legacy approaches.

Further research should examine specific technological requirements which could be applied in purchasing associations and estimate savings achieved by transitioning to blockchain solutions. Balanced Scorecard methodology as a performance measurement tool for management could be used in order to prepare verification for management whether blockchain technology applied in purchasing association will bring desired results and benefits. Furthermore, publicly traded companies which already applied blockchain could be analysed to prove if and how blockchain application affected stock price in different time periods.

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CONFLICTS OF INTEREST

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