# BLOCKCHAIN IMPLEMENTATION IN BUSINESS

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***Abstract:*** *The paper concerns the problem of the emulgamation of blockchain technology with business. Blockchain seems to be the one of the most recent technological innovations. This technology can be used in industry, the public sector, health care, education and business. The potential of this technology is not yet fully examined. Initially, blochchain was mainly used for cryptocurrencies, but this is only a part of the possible applications. Large possibilities of practical use result, among others, from the fact that making any change in historical records is impossible. There is no central server that could be vulnerable to cyber attacks. This technology allows to execute immediate financial transactions without intermediaries.*
*This article consists of an introduction after which the definitions of blockchain have been presented. The most important part of the paper presents the results of analysis related to blockchain implementation in business. In addition, the work includes assumptions regarding further development of this technology with particular emphasis on business.*
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**JEL Classification Codes: C80, A10, C88.**

## 1. INTRODUCTION

Internet commerce is forced to rely almost exclusively on financial institutions serving as trusted entities processing electronic payments. While the system works well enough for most transactions, it is still burdened with the defects of the trust-based model. Completely irreversible transactions are not possible in this type of model, due to the inability to avoid disputable issues and the participation of financial institutions in related mediation. Mediation costs, increase transaction costs by limiting the minimum practical size of transactions, thus eliminating the possibility of making small daily transactions. There is also a much higher cost of not being able to make irreversible transactions in the case of services, including irreversible ones.

The idea of cryptographic linking was revealed in 2008. At that time, internet user Satoshi Nakamoto published a study, in which he described bitcoin. The blockchain technology (called the block chain) that is used by bitcoin, was not known at that time (Kostro, 2018). The blockchain technology was first used in 2009 in bitcoin cryptographic as a way to post all transactions made with no double-spend the same funds (Piech, 2016).

### 1.1 Definition of blockchain

Blockchain is a public and shared database of all transactions (i.e., transfers of any amount between bitcoin portfolios, accounting entries) on the Internet, without central computers and in chronological order. Each transaction is saved in a block chain and coded using algorithms - without any exceptions, thanks to which the individual activity is verified on an ongoing basis by all users involved in the transfer. Blockchain can be seen as a dispersed database consisted of still increasing amount of information (records) which is grouped into blocks and connected to each other in such a way that each next block covers timestamp when it has been created as well link to previous block that is in fact its hash of its content. Due to this fact, it is impossible to modify data, delete or add false information. It is an open register that everyone can access (Kostro,2018).

The distinguishing features of cryptocurrency blockchain are:

- Decentralized and distributed database. This means that there is no unit that controls the data appearing in the block chain. In addition, all data and the entire blockchain history is available for download by every network user.
- Data (transactions) recorded in the block are immutable and irreversible. The transaction register that the blockchain offers can not be edited, once saved, the data remains in the block and it is not possible to change it.
- Transactions are encrypted by cryptographic tools. This ensures the security of data contained in the blocks.
- The transaction register is public. Everyone has access to the entire transaction history.

The features described above do not have to be a distinguishing feature of each block chain. Equally well, access to the database stored in the blockchain, can be limited only to authorized users. There is also a possibility to create a blockchain with the possibility of editing previously saved data. It all depends on the needs of the creator of the block chain and what will be recorded in the protocol (Kryptowaluty, 2017).

### 1.2 How block chain works?

Due to the fact that each transaction block contains a reference to the previous block, there is no possibility of changing a transaction previously cincluded in a block without modifying all subsequent blocks. In this way, an uninterrupted chain of data blocks is created. Thanks to this, it is impossible to make any change in the records (without changing the entire transaction history). In order to prevent such "undoing" or change in the bitcoin system, a proof-of-work (PoW) solution was used, which is required for approval of the transaction block (Piech, 2016).

The blockchain networks contain three elements:

**A cryptographic key pair**

A cryptographic key pair (public + private key) is stored in a blockchain wallet. It enables a secure digital identity reference. Also, it ensures that, data is exchanged between two persons without exposing the private details. By signing a transaction with the private key, an “ownership stamp” is placed on it. It means that the transaction can be traced back to sender, if needed.

**A decentralized, P2P network**

A decentralized, P2P network instead of a central authority. It is a community of users who decide whether a transaction is valid and can be added to the blockchain or not. The community uses mathematical verification to evaluate the history of the individual blocks that is proposed to be added and the “sender” signature validity. Once enough users verify that the transaction is valid, it is processed and recorded on the blockchain.

**The network servicing protocol**

The block, packed with transactional data, digital signatures and a timestamp, is broadcasted to the network's participants. The block verification process requires tremendous computing power. Public blockchains encourage the community to service the network by offering a reward for their effort – cryptocurrencies such as Bitcoin or Ether (Web3devs, 2019). The figure 1. presents the functioning the blockchain technology.

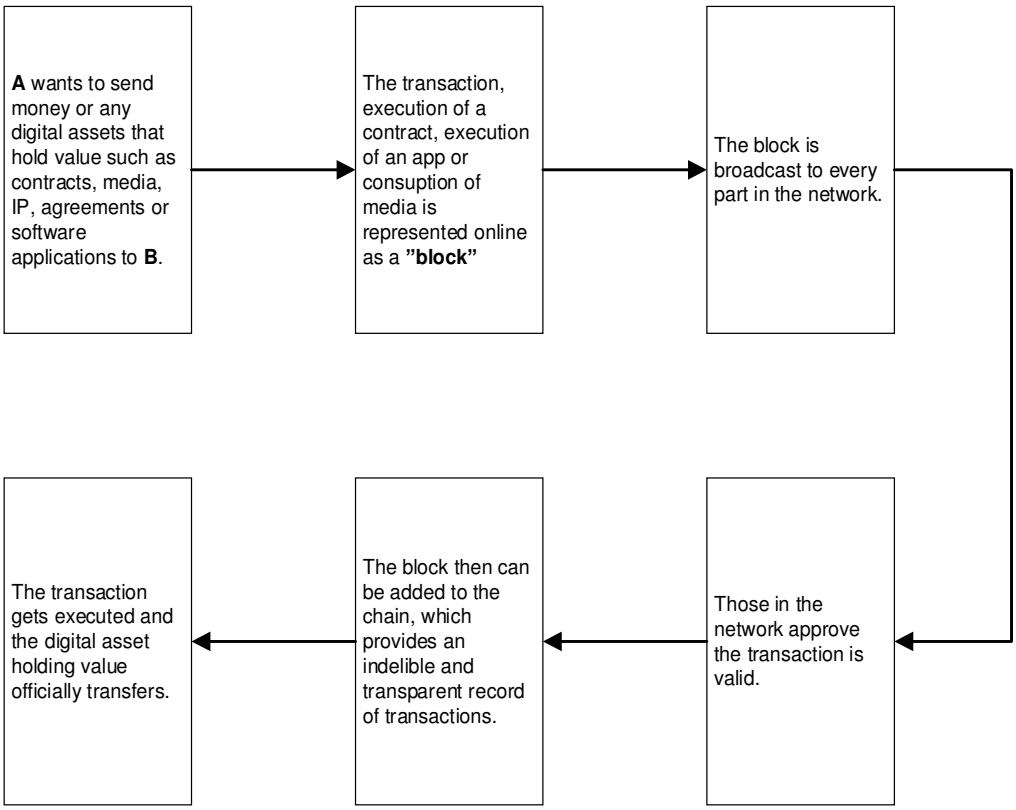


**Figure 1. Blockchain operation, own elaboration based** (Web3devs, 2019)

## 2. TYPES OF BLOCKCHAIN NETWORKS

Blockchain technology may be categorized into three groups: private, public and hybrid.

### 1.3 Private blockchains

There is a kind of security guarantee in a private blockchain. In this type, one can have basic information about the transaction participant. This is not a full procedure on the principle of "Know Your Client" as it is required in banks, but on the basis of this information one can identify who is the person "on the other side".

Its main function is related to the fact that this blockchain can only be downloaded / shared by a selected group of entities. Private blockchain is used when the business network contains confidential data or when the legal regulations do not allow individual members to use public blockchain. The example of a private blockchain is R3 Corda or Hyperledger. (Piech, 2016).

### 1.4 Public blockchains

The best example of pubic blockchain is blockchain of bitcoin. Its main function is related to the fact that this blockchain can only be downloaded / shared by a selected group of entities.

Public is generally available and transparent - everyone has an insight into the history of operation, which is made available in real time. Public blockchain allows the transfer of money and information in an environment, where, there is no certainty that the parties have fair intentions (Morabito, 2017).

### 1.5 Hybrid blockchains

The theoretical example of a hybrid blockchain is a private network with its own consensus protocol and access control mechanisms to the registry but uses a public blockchain for billing purposes to confirm the existence of a given state at a given time (proof of existence) or to use cryptocurrency (Jagodzinski et al., 2016).

## 3. RESEARCH METHODOLOGY

Based on a review of the literature, analysis of current research, the practical experience of the authors and increasingly visible trends in business, it could be claimed that conducting research on blockchain is reasonable .

The paper has been prepared primarily for businessmen since knowledge on blockchain is required. This article can also be used in universities, both by professors as well as students for their studies on IT in business.

**Problem Statement**

The main problem in the area of blockchain adoption in business is the lack of satisfactory scientific studies as well as model solutions.

**The Goal of the Study**

- To identify the implementation of blockchain technology in particular in logistics,
- To identify the role of blockchain technology in IoT,
- To present Framework for Supply Chain Management based on IoT Blockchain, IoT and Machine Lerning.

The necessary information was obtained from reports, articles, books, and scientific journals. The author's personal experience in operating a business since 1990 is an indispensable source of valuable, dependable and up-to-date information on blockchain technology.

## 4. RESULTS

### a. The implementation of the blockchain

Opinions are increasingly being made according to which blockchain will change business in a significant way over the next several years. Ultimately, blockchain can be used in almost every industry and economy. An important aspect is also the possibility of implementing this technology in business.

Blockchain technology is bringing companies to a turning point in their business operations. With the rise of data sharing and connected devices, companies need to evolve into connected enterprises that share data both within the organization and externally. Blockchain can solve many of the challenges around secure online transactions and data storage, and the technology is extremely scalable" (Lovens, 2019).

Currently, the most common areas of blockchain application can include:

**Banking, Finance, Business sector**

- Peer-to-peer financial markets (trading in various types of assets, debt securities, etc.)

- Unified transaction databases in banking systems (this should have an impact on a significant acceleration of transactions and reduction of operating costs in banking)
- Closer cooperation of companies within the extended supply chain. Such application can better optimize costs within the supply chain by coordinating activities between cooperating companies
- Open production networks - a concept of full transparency across the entire supply chain. The consequences of implementing the idea of scientists would mean the emergence of a powerful tool to verify the country of origin of individual components of a given product (control of changes at each stage of the supply chain), quality control etc.
- Smart contracts - intelligent contracts, i.e. autonomous programs, which automatic activation will ensure the guarantee and irreversibility of the implementation of the provisions between the "parties" of the contract.
- Support for management systems.

**Medicine**

- *Prevention of clinical test result manipulation*: The use of blockchain technology to control the process of conducting clinical trials will increase confidence in their results and will eliminate the admission of drugs with low clinical efficacy and a low safety profile.
- *Ability of storing health data in the block network*: Security of ones DNA or blood data will be ensured by blockchain technology.

**Internet of Things (IoT)**

- Integration of blockchain technology and IoTs can contribute to increase the anonymity of IoT applications. In turn, the use of smart contracts that are an essential part of the blockchain 2.0 solution will contribute to the increase of predictability on the Internet of Things.

**Public Services**

- Confirmation of property rights, including registration of buildings, land, patents, etc. The blockchain solution is characterized by a high resistance to manipulation of data contained in the block chain, which is of fundamental importance in the context of the sensitivity of data stored in the above-mentioned registers. What's more, the blockchain seems to be a solution which is resistant to corruption.
- Systems encouraging the use of "green" technologies. There are concepts of solutions for incentive systems (rewarding solar producers) based on the blockchain solution.
- The blockchain solution has been recommended as a tool to protect against computer piracy and that which supports protection against censorship on the Internet.

**Security**

- In the literature devoted to blockchain concepts, one can find a proposal to use a block chain to protect privacy in the aspect of: a) property rights to data; b) transparency and auditing of data, and c) access control.
- Improving the security of the public key infrastructure.

**Authentication systems**

- Verification of customer reviews. There is a concept of using blockchain to limit the number of unreliable as well as suspicious reviews.
- Verification of the due diligence process (Verified Corporate Due Diligence). The blockchain concept can also be used to secure intellectual property rights in the event of ending strategic alliances and mergers.
- Digital identity management systems.

Other areas of the use of blockchain technology are presented by Stokalski & Chruściel (2018) in the report "Blockchain in Poland. Possibilities and applications ":

- Durable media
- E-voting
- Planning and control of deliveries
- Prevention of phone theft
- Counteracting factoring frauds
- Decentralized distribution of digital content
- Robotic Process Automation (RPA) supported by blockchain technology
- Inter-bank payments and settlements using the Ripple network

### b. Blockchain in logistics:

Blockchain allows to reduce transport costs while increasing its safety and reliability. By implementing this technology, logistics companies will better understand the needs of shippers, which will contribute to creating standards that will increase the efficiency of commercial operations. We can also show our clients how they can use blockchain to facilitate the monitoring of shipments, reduce the amount of paper documentation, reduce errors or shorten delivery times and customs clearances. Figure 2. presents an example of the logistics blockchain consortium.

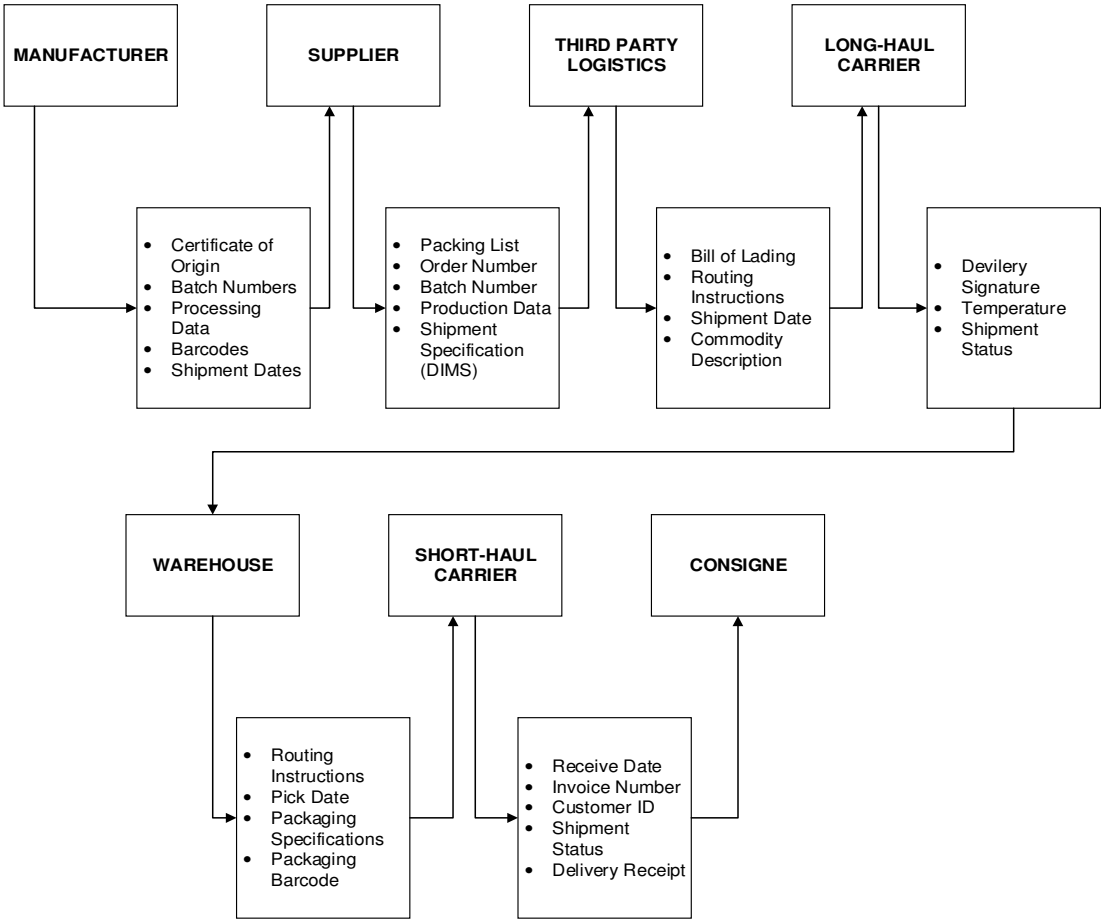


**Figure 2. The logistics blockchain consortium (Carter, 2018)**

### c. The role of blockchain in IoT

Internet systems of Things increasingly require the integration of many devices and solutions into a whole system. However, there are still no communication standards between devices that are accepted by all IoT system manufacturers. The existence of platforms based on the distributed data storage system in the form of blockchain can facilitate such integration. On the other hand, the excess of computing power in Internet of Things devices can be used to maintain the operation of the distributed data exchange register.

In the future, one or more blockchains could feed the next generation of IoT devices and systems, allowing the emergence of new business models for machine-to-machine transactions.

Blockchain systems due to the use of cryptography methods are characterized by greater resistance to possible attempts to modify data by unauthorized persons.

As of this moment, there is a race to develop a reliable and fully functional platform for the Internet of Things (IoT). The Solution to IoT is blockchain security.

However, there is a critical issue that IoT developers must solve: Security. There is a risk that someone gain access to IoT platform to control the whole ecosystem of devices connected to it: house thermostats, digital cars, and even purchasing systems (Innovation, 2017). Figure 3 below presents structure of the IoT blockchain network.

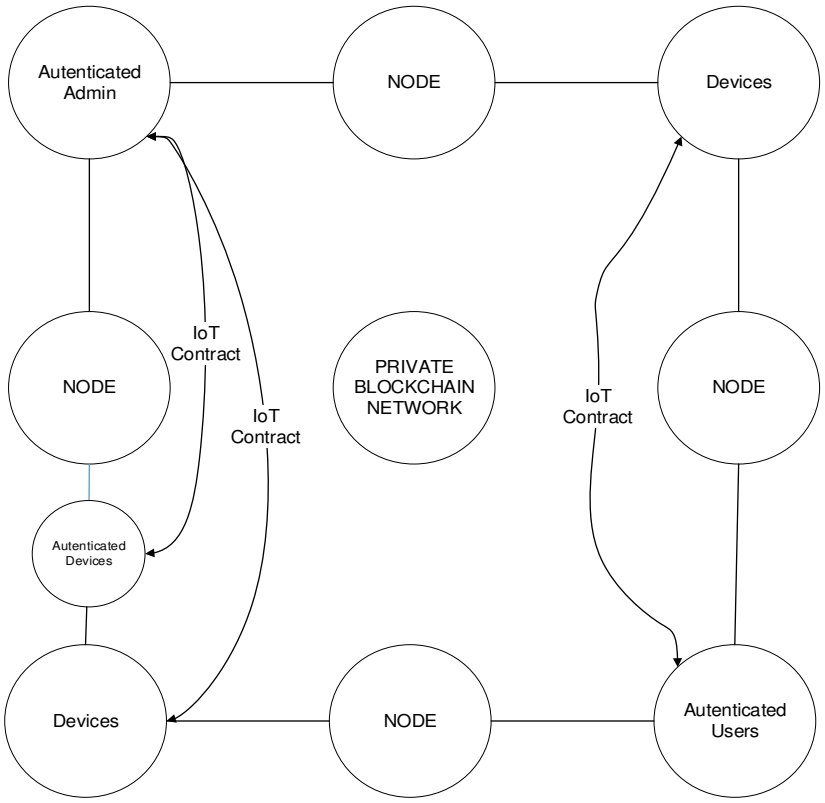


**Figure 3. Structure of the IoT blockchain network (FactoryCode, 2018)**

### d. Usage of bockchain technology within BusiessProcess Management Systems

It seems quite interesting to implement blockchain approach in BusiessProcess Management Systems (BPMS). As an example, you can see Caterpillar, which supports the creation the instances of a process model and allows users to observe the state of process instances and to execute tasks, see figure 4 below.

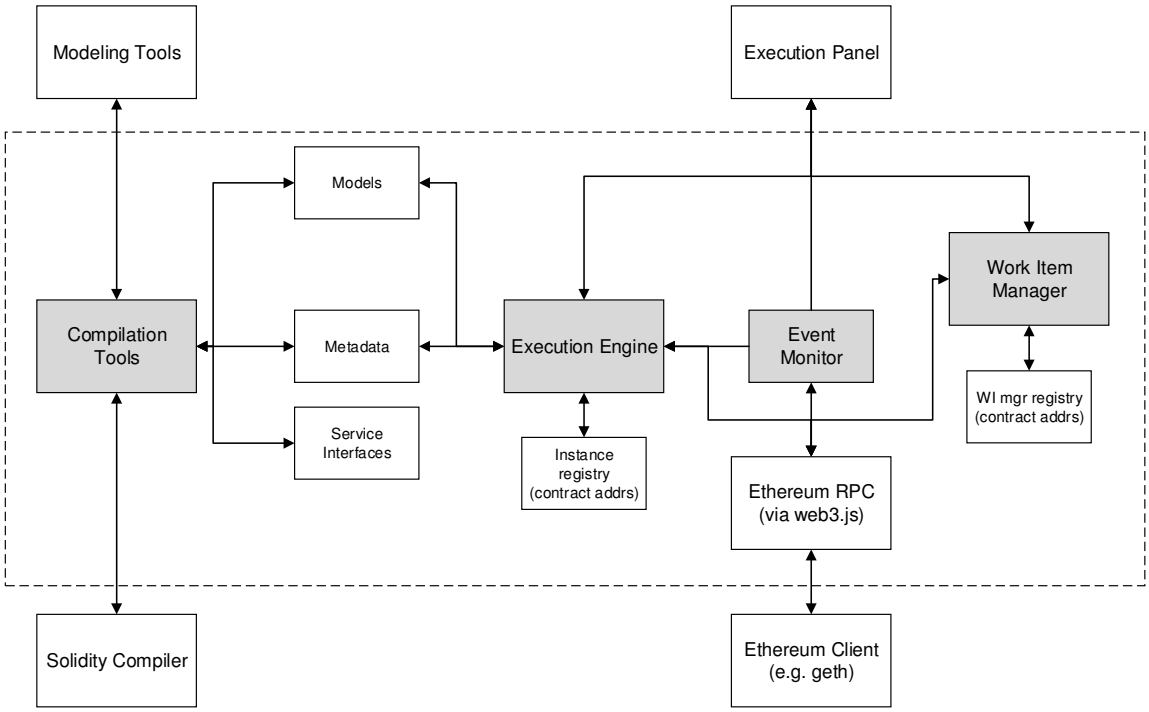


**Figure 4. Architecture of caterpillar (Lopez-Pintado et al., 2018)**

### e. Framework for Supply Chain Management based IoT Blockchain, IoT and Machine Lerning

Machine Learning is a branch of computer science which deals with learning of machines as the human brain can. It consists of sophisticated algorithms that helps the machine to learn. Heuristics are being used to facilitate the learning process. It is self-adaptive and no need to add new rules manually. Considering the learning and the self adaptive capability, the machine learning algorithms are being adopted by many applications. Machine learning can be used with blockchain technology in many applications to enhance performance and bring accuracy.

Machine learning techniques generally require huge amount of data for training purpose. Accuracy and adaptability of such systems can be measured during the training phase only. Therefore, the data provided at this stage plays a crucial role. Blockchain can provide the required data for the same. It can be assumed as a sophisticated linked list, which contains only maintains critical data in its blocks in an efficient way. Blockchain can also be called as distributed ledger. It has tremendous capability to manage almost all kinds of transactions in existence.

This will be also facilitated by GPU (Graphics Processing Unit) based huge computing power. Having increased speed and less energy consumption, this kind of machine learning based blockchain processing. In IoT based systems, connected devices in a peer-to-peer network, individuals can be allowed to rent resources out from each other. This also can be supported by centralized cloud providers. Such kind of technology will accelerate the performance of business system such as supply chain management in a very good way (Rahul Agrawal & Avneet Saxena, 2018).

A framework of the same is can be designed as given below on the figure 5:

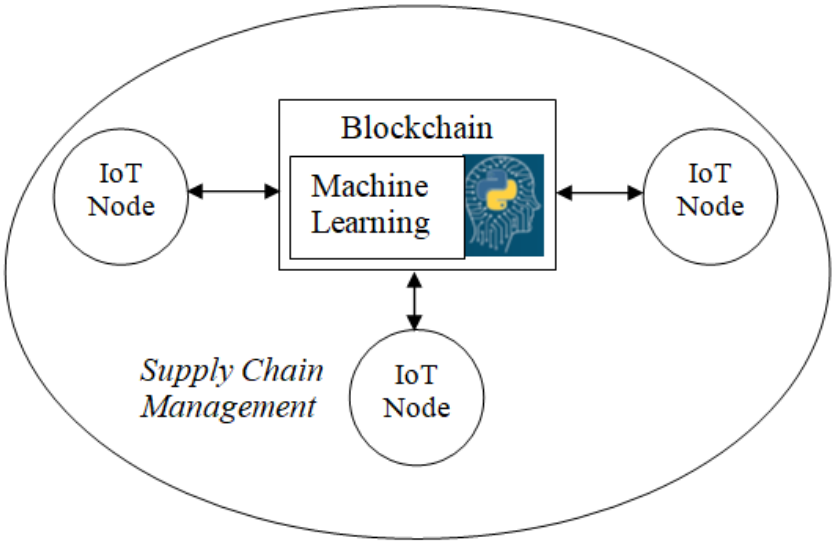


**Figure 5. Framework for Supply Chain Management based IoT Block Chain, IoT and Machine Learning, own elaboration**

## 5. CONCLUSION

The aim of the article is to highlight the use of blockchain technology in business. The role of blockchain in economy is still growing up. Acceleration and improvement of business processes, probable savings will increase the acceptability of the tool both in large and small companies. In addition to this, blockchain technology may play a major role in enhancing security in various business operations. The effect of this can be seen in such a situation where a company operates in a chain of different deliverables or dependencies. It is not important whether the company orders any goods from many suppliers or is a small supplier for a large company.

Thus, the logistics or supply chain management industries are those market segments where blockchain technology can offer a lot. Importantly, the application of solutions using blockchain technology in the company, according to many experts, is not complicated and does not require well trained IT team. They claim that it is enough to invest in an existing platform (e.g. IBM Blockchain) which allows to build a blockchain network in a private virtualized environment.

The proposed framework for Supply Chain Management based IoT Blockchain, IoT and Machine Lerning seems to be added value for academia and business as well. It can be developed and analyzed both by professors, students, and people in the business. Also, this proposal has didactic value because it can be used during classes with students during subjects such as IT in business, Internet of things, management and many others.

In this paper the authors proved that in the future, one or more blockchains could feed the next generation of IoT devices and systems, allowing the emergence of new business models for machine-to-machine transactions.

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