

# Analysis of the Application of Blockchain in the Military Supply Chain

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**Abstract.** The military manufacturing is a complex and huge industry. With the rapid development of economic globalization and the deepening of industrial division of labor, issues such as trust management between enterprises, privacy protection during interaction, and the authenticity and transparency of product information have become increasingly prominent. The technical characteristics of the blockchain itself can play a great advantage in the field of collaborative management of the military supply chain. This paper studies the current development status of blockchain technology, supply chain collaboration, military supply chain and other fields, and the application direction of blockchain technology in various fields are analyzed and summarized. It discusses and summarizes the possible combination of the current military supply chain data collaborative sharing and the blockchain, also, some possible improvements are proposed.

**Keywords:** military supply chain; blockchain; data collaborative sharing

## 1. Introduction

Supply chain refers to the overall functional network chain that realizes the control of products, information, funds and other elements around the core enterprise based on a certain organizational plan. Supply chain collaborative management refers to the cooperative management of core enterprises, parts suppliers and distributors, is also the cooperation and mutual effort of each participant in the supply chain in order to improve the overall competitiveness of the supply chain. With the steady improvement of the degree of economic globalization and the division of labor and cooperation among enterprises are constantly strengthened, today's competition is no longer the competition between enterprises, but the competition between supply chains. In the changing business environment, the large and comprehensive vertical development mode can no longer meet the development of enterprises. Many enterprises gradually begin to seek the integration of professional competitiveness and core values, and turn to the cooperative way of resource allocation. Supply chain collaborative management can give full play to the advantages of blockchain. The mapping of different nodes in the blockchain can exactly correspond to the matrix composed of all parties in the supply chain, which highly coincides with the real business network. Blockchain technology enables collaborative management of supply chain, which can effectively realize the whole process delivery of supply chain value.

The military industry is a special industrial organization. In the long-term development of the defense industry, it has formed a set of material supply chain mode with the macrobusiness as the core and the subsystem enterprises providing supporting products. With the rapid change of tasks and ordering system in the new era, the contradiction between the existing military supply chain management mode and the development of national defense industry is increasing day by day. In order to solve the shortcomings in related fields, some relevant departments and personnel have made in-depth theoretical analysis on the cooperative management mode of military supply chain combined with blockchain, which is used to make up for some shortcomings of military supply chain, such as unscientific demand submission, complex business processes, weak management and control ability, and weak cross-organizational coordination ability. This paper analyzes and sorts this out, discusses the potential development direction of blockchain technology in military supply chain, and provides suggestions for the cross-border integration of blockchain technology and military supply chain.

## 2. Military Supply Chain

### 2.1 The development of blockchain

The birth of blockchain can be traced back to TCP/IP protocol, and its technology development relies on cryptography. In 1976, Bailey and Martin discussed and analyzed the research direction of cryptography, including asymmetric algorithm, hash and other encryption methods, which played an important role in promoting the birth of blockchain. In the 1980s, distributed computing entered the practice stage, elliptic curve encryption algorithm was applied to cryptography, payment system E-Cash was also proposed, and the modern cryptography framework has been basically built.

The rapid development of blockchain is concentrated after 2001, which can be divided into three stages. The first stage takes the birth of bitcoin as a node. Satoshi Nakamoto published the white paper of electronic cash on the Internet and dug out the first Bitcoin block in 2009, and the concept of "blockchain" was born since then; In the second stage, blockchain is applied to the distributed platform, and its representative technologies include Ethereum and various alliance chains and private chains. This kind of technology provides the basic scheme of blockchain application, greatly reducing the limit of users to build blockchain applications. In this stage, a number of decentralized distributed application platforms are built globally. In the third phase, the block chain gradually realized the value of the concept of the Internet, not only in the financial sector has launched a new trading patterns, and gradually applied to every field of society, such as medical, charity, logistics, etc., based on block chain technology, almost any value can be stored in digital way and record, along with the expansion of application block chain, Every aspect of human society is gradually affected.

### 2.2 Status quo of military supply chain

Because of the unique social function of the military industry is different from other industries, in the military supply chain, the core of the macrobusiness is formed, the multilevel sub-system of enterprises to provide corresponding parts, and contains the special mode of raw materials manufacturers.

As shown in Fig. 1, in this model, the military services propose unified requirements, the macrobusiness undertakes the production, and the hierarchical responsibility management mode is specifically implemented by the sub-system enterprises. Product information is generally transmitted step by step. Material needs are transferred from the grass-roots army to the group army, then to the theater services and finally to the services. The services customize procurement plans and pass them to military enterprises. The process involves multiple levels of military departments and storage institutions, and needs the cooperation between multiple subjects, which is a special complex and long chain.

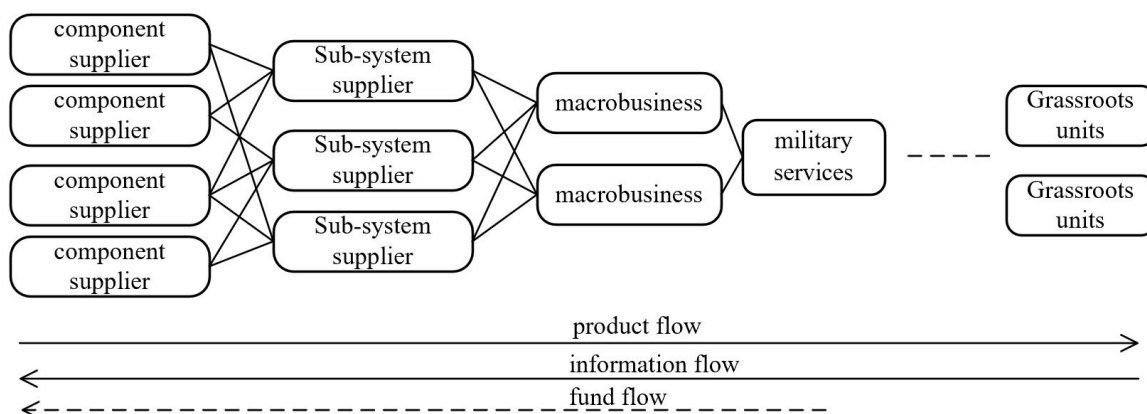


Fig. 1 Military supply chain structure model

## **2.3 The main characteristics of military supply chain**

In addition to the basic characteristics of the general supply chain, the military supply chain has the following characteristics:

### **2.3.1 Complexity**

Each level of the entire military industry chain involves a large number of suppliers, which are composed of enterprises distributed in different regions. Because of the different nature of the enterprises, its structure is also more complex.

### **2.3.2 Multilevel**

The military supply chain has multiple levels from the top down, from the services that make procurement plans to the raw material providers, with a hierarchical management system to guarantee products and services.

### **2.3.3 Intersectionality**

In the same type of unused equipment, the same verified parts are often used, and there is a cross structure between the subsystem enterprises and the macrobusiness.

### **2.3.4 Stability**

Military supply chain has strong stability, subsystem enterprises and parts suppliers are generally fixed enterprises, the supply chain forms a stable whole.

## **2.4 The deficiencies of the existing military supply chain management**

Military supply chain is a material and information circulation chain composed of supply management departments at all levels, storage institutions, grass-roots troops, military enterprises and their supporting facilities. Is the primary purpose of a military supply chain management under the condition of minimum comprehensive cost of finished goods designated delivery regularly, though China's current military supply chain construction has made great progress, but still is apart from the modern supply chain system has a certain gap, low trust between mainly embodied in the main body, business process, low information transparency, coordinated regulatory ability is poor, Management decision making is slow. The deficiencies of military supply chain management can be summarized as the following points.

### **2.4.1 Unreasonable demand submission**

Submission process of the military supply chain management requirements are often adopted to step up, superior to demand information reported by the lack of a reliable means of validation, due to the asymmetry of information, to ensure requirements are often need to rely on past experience increases material reserve, this extensive, unscientific management way also can produce some problems, For example, the proportion of stagnant materials in the basic warehouse is too large, and the management personnel and maintenance costs increase.

### **2.4.2 Long business process**

In the whole military supply chain business process, material demand report and allocated all need through multiple layers, the business process architecture complex, secrecy and the influence of different criteria, the information circulation and higher cost, production, transportation, delivery process of military supplies, too multifarious information report, summary, the examination and approval, and waiting for the military enterprises seriously affect the overall operation efficiency.

### **2.4.3 Lack of collaborative control ability**

The management of military supply chain involves logistics support departments, grassroots troops, suppliers and supporting enterprises, warehousing departments and many other organizational units, including demand summary and prediction, material procurement and

distribution, product storage and transportation and other links. The transmission of information needs the summary and approval of managers at all levels. In the whole cycle of product production, the management department and each unit cannot timely obtain the whole process operation information of supply chain, and there is a lack of effective quick response mechanism to problems.

#### 2.4.4 Low efficiency of collaboration and sharing

Due to the particularity of the military industry, the secrecy level of each unit in the supply chain is not the same. In the traditional supply chain system, it is impossible to achieve efficient permission allocation and collaborative sharing, which leads to the decline in the efficiency of the whole supply chain system.

### 3. Integration Solution of Blockchain and Military Supply Chain

#### 3.1 Advantages of the integration of blockchain and military supply chain

In terms of data security collaboration and sharing, the process combing and operation data recording in each link of the traditional military supply chain system based on blockchain technology can effectively solve some major drawbacks of the traditional supply chain system. For example, the problem of information islanding in the traditional supply chain system, the "bullwhip effect" and some existing problems in the military supply chain, etc. Aiming at the scenario of data collaboration and sharing that can be transmitted by network and has high security requirements, safe and reliable supply chain collaboration and sharing can be achieved by classification authority allocation.

In military supply chain collaboration and authority for examination and approval process of safety regulation, block chain technology can provide the function of the supply chain process action on the chain, so the demand for military data in collaborative supply chain system, permissions Settings, permissions, examination and approval, access to data, and the corresponding data record on block chain, Blockchain data is here like a public data encrypted system log, recording the status and operation of the system in real time. When the operation of some users or devices needs to be reviewed in the supervision process, the corresponding blockchain account information can be analyzed to find, discover, and check the problem, so as to achieve the purpose of tracking and reviewing the operation. In conditions allow, also can use big data, artificial intelligence, deep learning and other related technical implementation of chain on big data analysis and application of data can be done such as early warning, artificial inventory data entry abnormal remind remind, machinery and equipment, process, unusual behavior anomaly detection and warning, permissions, abnormal remind all sorts of data based on chain such as the function of the application.

In the aspect of fine material management, based on the Internet of things, RFID and other technologies, it can be realized through blockchain technology without manual automatic tracking of materials, effectively prevent some problems such as records or judgment errors caused by manual misoperation, and realize accurate tracking and traceability of materials and reasonable utilization of expenses. With the combination of blockchain technology, data can be shared safely and justly across departments or even among multiple units.

#### 3.2 Integration approach of blockchain and military supply chain

Integrated military supply chain management process, the integration of blockchain and military supply chain with production enterprises as the core can be summarized into four aspects: demand management, adjustment management, procurement management and distribution management. Specific implementation approaches may include but are not limited to the following approaches.

### 3.2.1 Demand management

In the demand management stage, the process includes the reporting and writing of material requirements. The basic troops write demand information into the demand block according to the actual situation, including material category, quantity, demand time limit, etc. The management department writes all the summarized information into the block, and distributes the audit results back after summarizing them.

### 3.2.2 Adjustment management

In the adjustment management stage, after summarizing the situation of each department, the management department will conduct adjustment management according to the demand, and write the information of stagnant materials and adjustment through the adjustment block. In the adjustment block, the categories of materials are determined in the hash value, and the quantity and status of materials are written into the timestamp to ensure the accuracy of information transmission.

### 3.2.3 Procurement management

In the procurement management stage, the management needs to grasp the needs of the grass-roots forces and stagnant materials to determine the final procurement plan. After the procurement plan is determined, material information is delivered to military enterprises through the procurement block to complete the order. Material categories are defined by hash value, and the time stamp contains unit price, quantity, completion time and other information. Military enterprises and their parts supporting enterprises read the procurement information to organize production.

### 3.2.4 Distribution management

In the allocation and management stage, based on the preliminary demand and procurement information, the military enterprises and the grassroots troops are directly connected, and the mapping method is written into the contract block and sent to both sides. The supply management department is not directly involved in the handover between the military enterprises and the grassroots forces, but at the same time can grasp the material information in the block to achieve real-time supervision. In the contract block, the hash value is used to define the material category, and the timestamp contains the quantity, status, time and other information. In the process of goods handover, the management department can supervise the handover situation in real time and make the next step planning according to the situation.

## 4. The Impact of Blockchain on Military Supply Chain

First of all, the military supply chain management system based on blockchain not only breaks the obstacles of the traditional logistics equipment support system, but also retains the existing hierarchical management mode of the military industry. By means of its information point to point transmission characteristics, flat management structure, the supply chain through downsizing optimize the structure of material circulation, distribution and inventory, improve dull material utilization, the authors of the core enterprise efficiency in the supply chain, supporting economic efficiency of enterprises comprehensive promotion and the rational use of military spending.

Secondly, by virtue of the decentralized advantages of blockchain, military supply chain management allocates responsibilities and rights of each node, and writes each business, process and rules into the blockchain in the form of smart contracts. The military supply chain will no longer rely on the traditional organizational structure. Each node unit can omit the process of asking for instructions from the superior and independently complete the on-chain contract according to the business process, saving labor and time costs.

Finally, the military supply chain management combined with blockchain technology has completed the organic combination of multi-departments and multi-nodes, and built an efficient and

transparent decentralized organic assembly among the army, logistics support departments, military enterprises and their supporting enterprises, streamlining the business process and strengthening the business support ability. The manager and the executive can obtain the relevant material information quickly and accurately within their respective business scope and make scientific decisions and reasonable arrangements based on this. Abbreviations and Acronyms

Define abbreviations and acronyms the first time they are used in the text, even after they have been defined in the abstract. Abbreviations such as IEEE, SI, MKS, CGS, sc, dc, and rms do not have to be defined. Do not use abbreviations in the title or heads unless they are unavoidable.

## Conclusions

Military supply chain is a typical collaborative scenario, which is a complex and multi-party long business chain. Blockchain has the characteristics of distributed storage, data transparency in the alliance organization, and anti-computing reform, which can directly make up for the deficiencies in the current military supply chain. At present, military supply chain management based on blockchain technology is still in its infancy, and there is a lack of comprehensive and systematic research. There are still many solutions to problems that need to be verified by practice. The empowerment of blockchain technology is the opportunity and challenge of modernized informationized military supply chain management.

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