MILITARY BLOCKCHAIN FOR SUPPLY CHAIN MANAGEMENT

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ABSTRACT

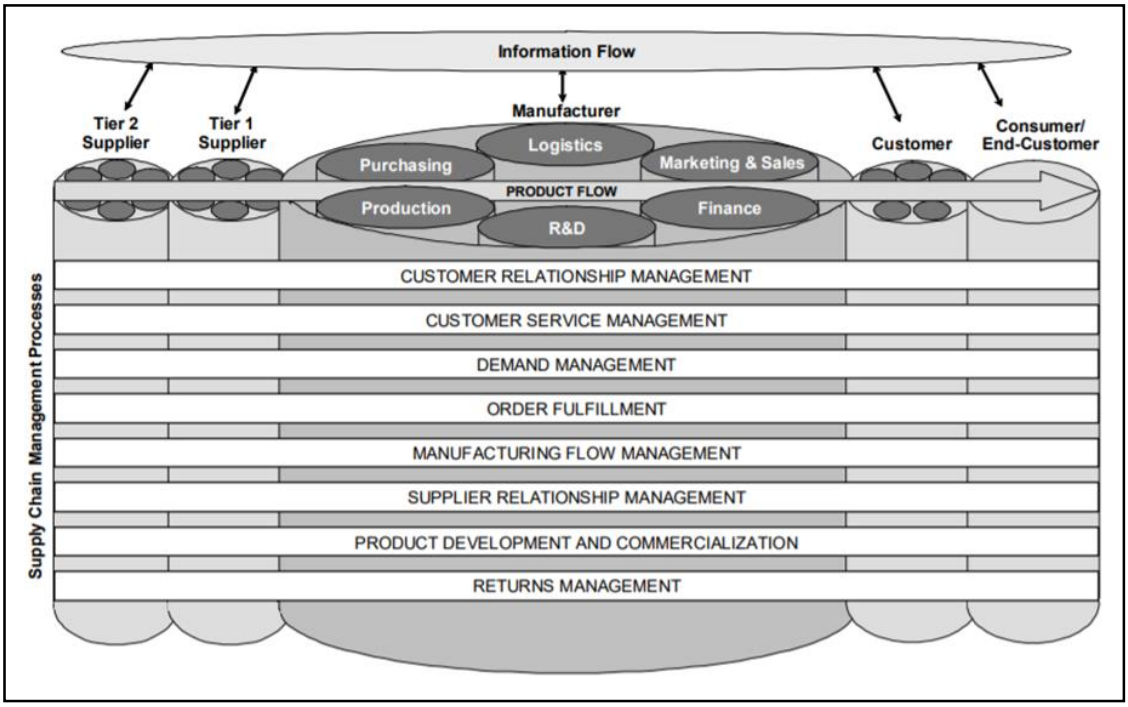
Counterfeit is a global problem where it has been growing gradually all over the world. The Global Brand Counterfeiting Report predicts the total of global counterfeiting may reach USD 1.82 Trillion by next year. The report also reveals counterfeiting products are ranging from household products to defence spare parts. Furthermore, Malaysia Ministry of Domestics Trade and Consumer Affairs has seized various counterfeit products, including counterfeit spare parts. US Department of Defense estimates there are about more than 15% of military counterfeit spare parts including weapons and vehicles. Military assets should be at a high level of readiness at all times. The spare parts supplied shall be guaranteed in terms of authenticity to ensure military assets are functioning properly at its best. Counterfeit spare parts are vulnerable to dangerous malfunctions. This study is expected to avoid counterfeit military spare parts supplied to the military base to ensure all assets are functioning properly. Therefore, the aim of this paper is to design a conceptual model of Military Blockchain. The main objective is to trace movement of the spare parts from the first-tier supplier until delivered to the end customer. Military blockchain will improve the process of current supply chain management. This technology notifies all involved parties on the movement of spare parts. Blockchain transparency will assist multiple parties to track and trace blockchain records action at the same time without a loss of data. Theferore, integrating blockchain in the current military supply chain management will facilitate all parties involved to track and trace spare parts in a complex networked of military supply chains.

Keywords: Transparent, trace, cryptographic, hash, logistic

INTRODUCTION

Supply Chain Management (SCM) is a complex and extensive network. SCM involves the production and distribution process and involves many parties. SCM is responsible for ensuring the movement of raw materials from the first-tier supplier until delivered to the end customer as a final product. Before reaching end products, each product segment through a supply chain series is called a multi-tier supply chain. Fig. 1 shows the eight key processes that need to be implemented within and across firms in the supply chain.

Figure 1: Key supply chain business process (Lambert et al., 1988)



However, there is a risk of potentially replacement parts or segments, poor quality replication, and cancelled products. When certain conditions are not met, they cause the product to be restored or reproduced, and the process will continue to increase the delay in obtaining the final product. Thus, among the identified issues arising in the supply chain pratices are i) lack of follow-up and coordination (Rosena et al., 2008), ii) incurred cost (Anderson, 2017) and iii) traceability (Madhwal & Panfilov, 2017).

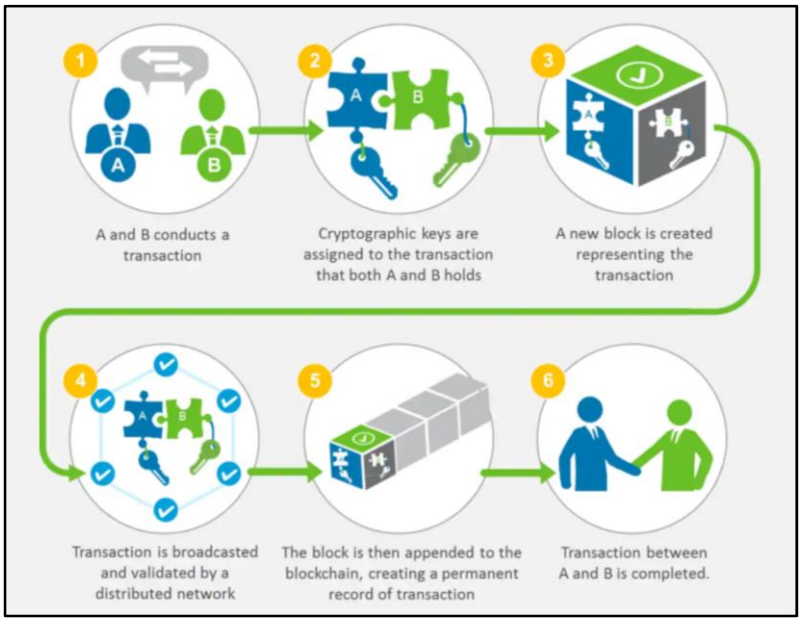
This study will focus on traceability aspect to track and trace supply elements as it moves along the supply chain from raw material to final products. Traceability provides several benefits to stakeholders. One of the benefits is the ability to investigate and back track any problems related to components or ingredients. The source of problem will be identified for further rectification. In addition, traceability aspect may reduce and eliminate the number of counterfeit products in the market.

Counterfeit products may affect the economy of a country. Furthermore, counterfeit product is a gobal problem. The Global Brand Counterfeiting Report predicts the total of global counterfeiting may reach USD 1.82 Trillion by 2020 (Global Brand Counterfeiting Report, 2018). The report also reveals counterfeiting products are ranging from household products to defence spare parts. Furthermore, Malaysia Ministry of Domestics Trade and Consumer Affairs has seized various counterfeit products, including counterfeit spare parts. On 28th June 2018, Ministry of Domestic Trade and Consumer Affairs Malaysia (KPDNHEP) seized counterfeit car spare parts of Kia and Hyundai amounting to RM24,064.00 (Sigh, 2018). The seized products are including conveyor belts, spark loops, oil filters, air filters and fuel filters. During other operation on April 2019, KPDNHEP seized fake engine oil worth RM257,000.00 (Bernama, 2019). Furthermore, US Department of Defense estimates there are about more than 15% of military counterfeit spare parts including weapons and vehicles. Authorities and law enforcement have increased the number of seize operations from time to time; however, the number of counterfeit products is still growing enormously. This is due to high demand of counterfeit products since their price are affordable.

BLOCKCHAIN

In industry 4.0 and the era of IT, blockchain technology now becomes popular. Blockchain is a decentralized and distributed digital ledger or database of records and transactions that facilitates the process of recording transactions and tracking assets within the business network. Blockchain also may prevent replacement of genueine product with counterfeit product. Other benefits of applying blockchain in SCM are transparent process, traceable and recorded operations (Britchenko et al., 2018). Moreover, Westerkamp and Küpper (2018) propose a blockchain based supply chain traceability system using smart contracts. This concept based on two key ideas: (i) introduce digital tokens to represent physical items and maintain a relationship between source and product; (ii) additional features such as certifying goods, transferring, splitting and combining tokens to facilitates cross-business traceability. Smart contracts are computer programs that enforce rules without needing a third party (Madhwal and Panfilov, 2017). In this practice, contract owners create digital tokens after producing or obtaining physical products. Fig. 2 shows the transaction process on a blockchain network.

Figure 2: Blockchain Process (John, 2017)



Currently, few military defense are exploring the needs of blockchain in defence and security in maximizing its capacity and capability in terms of assets, actions, and operations. US Department of Defense are applying blockchain technology in their defense and security fields (Simkin, 2018). Lebanese Arme Forces shows the interest in blockchain technology to maintain the centralized army (Chedrawi & Howayeck, 2018). Similar to other industries, Military SCM is complex and complicated. There are seven possible use cases for military blockchain (Fig. 3) such as tracing defence shipments/contract, secure government and

battlefield messaging, cyber warfare preparedness, preventing data theft, NATO applications, Protecting weapons systems and military additive manufacturing.

Figure 3: Seven Use Cases for Military Blockchain (Sam, 2018)

This paper is focusing on tracing defense shipments. A complex supply chain derives a critical need of decentralized and digitize transaction in ledger. Moroever, security is extremely important in maintining supply chain shipment of weapons, gear, and spare parts due to the exponential growth of counterfeit military products.

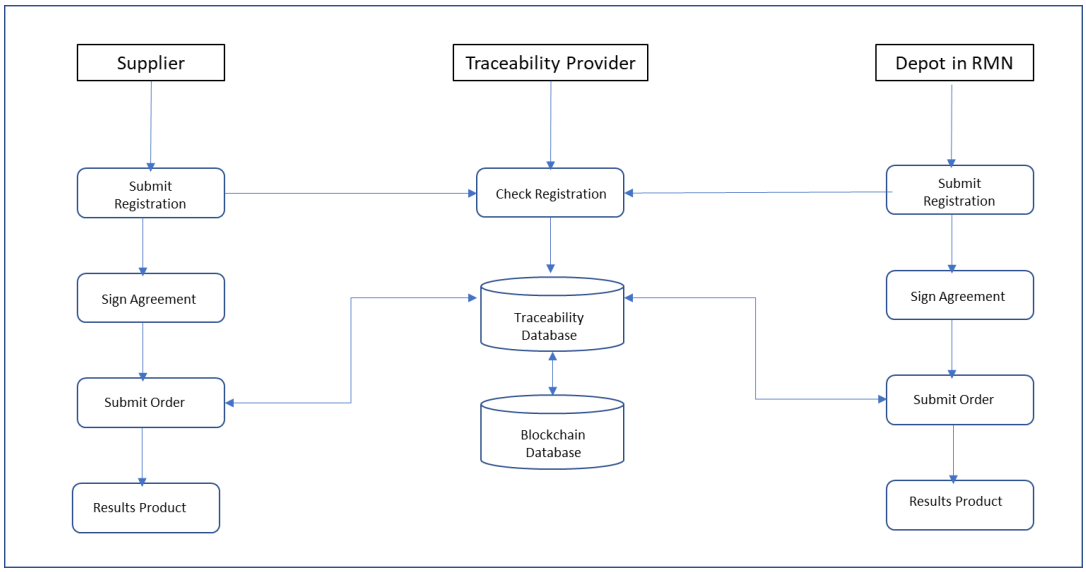
PROPOSED FRAMEWORK FOR MILITARY BLOCKCHAIN

In this paper, the proposed blockchain framework is focusing on Navy defense shipment. Navy handles operations on and under the sea, in the air, and on the gound. Therefore, navy assets should be at a high level of readiness all times. To provide the best service, it begins with how these assets are maintained and improved. Ships are divided into several segments such as engine parts, decks, bridge and galley. Each segment is using different types of spare parts. The spare parts supplied must be genuine to ensure the assets are functioning properly. It is also to prevent severe damage caused by counterfeit products. Furthermore, the spare parts supply must follow specifications to avoid delay in the delivery. Any delay of the spare parts may affect the duration of vessel completion. Therefore, supplier must monitor third-parties at all time during transaction. Traceability is important to keep track the spare part movement from first-tier supplier to the navy depot.

Traceability element involves different participants such as supplier, traceability companies and other service providers. This element needs synchronization among participated organizations. Customer requires data transparency and immutability to check the originality. (Xu et al., 2019)

Fig. 4 below is a recommendation for SCM for the blockchain in Navy:

Figure 4: Military Blockchain

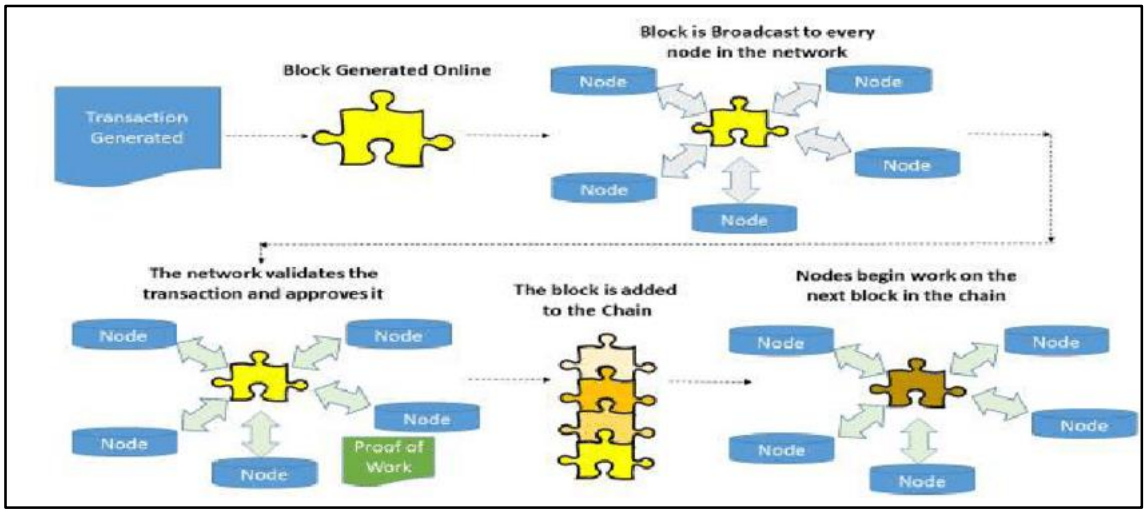


- A fully private blockchain where it is a closed off to military and suthorized spare parts suppliers.
- All the spare parts supplier must register as a certified company that has a traceability certificate.
- Navy Depot such as West Fleet Supply Depot (WFSD) needs to register as a company to check the originality and authenticity of the spare parts.
- Blockchain database will replace the current procedure in receiving the spare parts in Depot.
- A blockchain implements a distributed digital ledger. The ledger verifies and stores any transactions for general purpose. (Xu et al., 2019)
- A cryptography technique is applied for secure communication within military blockchain.

This blockhain maintains a replica of the ledger at each node that gets updated with consensus. However, as an owner of this blockchain, navy depot has a fully privilages on these chains. Some of the privilages are including give read access to transaction, single authority to override or delete commands on a blockchain, avoid run a full node without authorization and make transaction with their consent. This type of blockchain is applicable to defense sector due to nature and sensitivity of information gathered and stored.

This military blokchain contains a series of transaction (blocks/nodes) with cryptographic keys for users. Any changes of block will produce a proof-of-work document. The document contains information about the current transaction against previous block. Then, the document will be broadcasted to other blocks. Other blocks will validate the transaction upon approval. Upon the hash of accepted block, a new block will be appended to blockchain. This secure blocks of chain from fraud and tampering (Simkin, 2018). Fig. 5 is the blocks/nodes on the blockchain process.

Figure 5: Nodes on the Blockchain Process (Lewis, 2016)



The aim is to propose a military blockchain which provides a precise, verified, auditable and decentralized record keeping over different parties engaged in a transaction or exchange. Thus, blockchain will translates it into the military business where there exists the role of the substantial number of individuals and high-level security.

CONCLUSION

Integrating blockchain technology within SCM facilitate the tracking transaction of genuine spare parts. The usage of cryptograpy in this proposed framework will secure the whole chain from any tampering. The communication is secured because all nodes must agree for any exchange and changes of information. Hence, this technology produces an efficient and transparent supply chain for military. It will reduce fraud and over price spare parts. Therefore, it is a strong motivation to integrate blockchain into SCM to validate orders information and manage supply chains. This study is proposing the integration of military spare parts blockchain into military SCM. This is important to take required new measures such as adoption blockchain technology to produce traceable node in supply chain for military spare parts.

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