Handling Industrial Consumer Rights by Using Blockchain

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Abstract. The main objective of this research paper is to propose a business model to deal with warranties of products bought by clients and present a prototype implementation for a vehicle supply chain. Many customers have fake warranties which reduce customer loyalty to large companies. Therefore, the blockchain features can be used here as a technical solution. It can connect each device data and product lifetime to preserve consumer rights, by arranging companies with the highest guarantee under the blockchain. Furthermore, a proposed blockchain business model (BBM) is presented that regulates the life cycle of any product, the manufacturer under the control of the blockchain. The paper provided a case study for vehicle industry. After implementing blockchain structures, it was proven and observed that the blockchain is scalable to huge number of devices. This leads to obvious results and transparency among the giant companies in the interest of the client, and eliminating consumer rights issues such as black market and over prices.

Keywords: Blockchain · Governance · Consumer rights · Supply chain · Warranties

1 Introduction

Blockchain offers business value in 3 main areas that are value transfer, smart contract, and recordkeeping [1]. Recordkeeping considers creating immutable records under a consensus protocol without reliance on a third party.

Governments can adopt blockchain to start a cycle of trust in the legal and financial system, in areas such as identity management, voting and protecting sensitive data [2].

This paper proposes a business model that regulates the life cycle of the consumer with governance of the Ministry of Industry and the manufacturer under the existence of blockchain. Blockchain can be used as a preservation of consumer rights and customer satisfaction feedback.

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The rest of this paper is organized as follows. Section 2 summarizes an overview of interdisciplinary blockchain and supply chain governance. Section 3 is the proposed business model in details and its implementation, and showing blockchain structure. Finally, Sect. 4 contains conclusion and future directions.

2 Overview

2.1 Blockchain Basic Concepts

Blockchain is basically a decentralized peer-to-peer (P2P) network of transactions, without a central authority [3].

There are four types of blockchains as shown in Fig. 1 [4]. Public permissionless blockchain can be read, written and committed by anyone such as Bitcoin. Public permissioned blockchain can be read by anyone, written and committed by authorized participants such as supply chain ledger for retail brand. Consortium blockchain is read by a restricted set of participants, written and committed by authorized participants such as a set of banks with a shared ledger. Private permissioned blockchain can be read, written and committed by network operator only such as an external ledger shared by an enterprise and its subsidiaries.

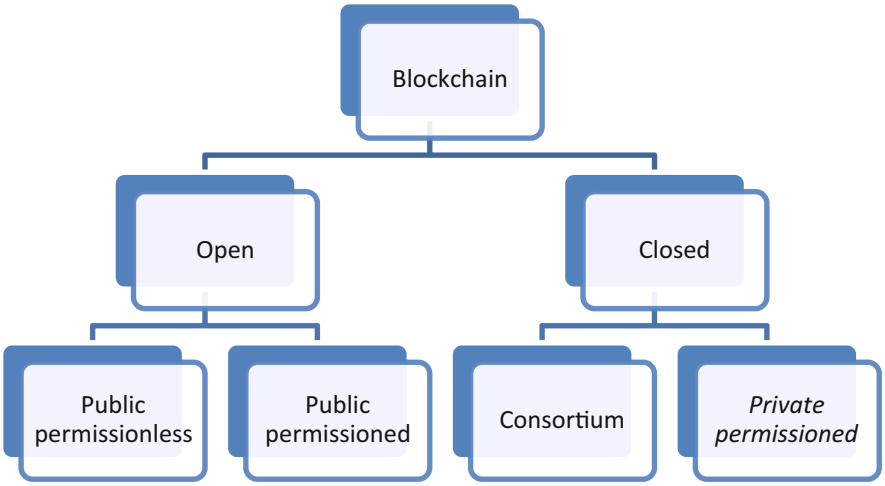

Fig. 1. Blockchain types [4]

Despite the supremacy of blockchains and their potential, there are three weaknesses, namely scalability, privacy and governance [3]. The paper in hand focuses on governance problem for two reasons. First, governance problem emerges after the collapse of widely-advertised platforms. Second, many solutions are proposed to scalability and privacy problems but they all seem to need "some degree of centralization" of governance as in a "Masternode" [3].

2.2 Blockchain-Based Governance

There are twelve principles of blockchain-based governance [5]. First, for ages the State and bureaucracy have been a remedy of scaling problem in order to achieve consensus and coordination. Second, State as a hierarchical organization can be modeled as a Single Point of Failure (SPOF), which means that the failure of a component yields to the failure of the entire system. Third, distributed architectures introduce trust-by-computation concept. Forth, Decentralized Autonomous Corporations (DACs) in which relationships between individuals and the State can be automated by "a series of instant atomic interactions." Fifth, a nation can be put on the blockchain in a Starbucks-style public administration. Sixth, globalized government services without borders that interact with each others in order to achieve citizen satisfaction. Seventh, blockchain can help achieving direct democracy. Eighth, futarchy in which individuals vote twice, one for general outcomes, then for proposals to achieve those aforementioned outcomes. Ninth, decentralized services are still based on the authority of the State. Tenth, a new social contract characterized by DACs, with no need for the State as a novel direction affecting the citizen culture. Eleventh, franchulates that is a mixing of "franchise" and "consulate", which means availability of the blockchain anytime anywhere. Twelfth, authority floating freely that is already happening in information industry, in which works operate in open areas.

2.3 Blockchain for Supply Chain

A Supply Chain consists of all stakeholders involved in achieving a customer's request [6]. Figure 2 shows the product journey from order to delivery.

Blockchain has a great impact in achieving supply chain six objectives of cost, speed, dependability, risk reduction, sustainability, and flexibility as narrated in [7]. However, there are many supply chain due diligence challenges regarding to blockchain such as supply chain fragmentation, the traceability of goods flow, transparency and risk information [8].

Challenges of adapting blockchain are divided into a dichotomy of technical and non-technical [8]. Technical ones consider asset digitization, interoperability, and privacy versus transparency. Non-technical ones consider data model standardization, governance, embedding responsible business conduct and including informal actors.

2.4 Blockchain as a Business Model (BBM)

Blockchain can disrupt the existing business models by three ways [9]. First way is by authenticating traded goods. Second way is by facilitating disintermediation. Third way is by enhancing operational efficiency.

Appropriateness of BBM is based on many conditions [3]: such as verification of both transactions and data is required; feasibility of disintermediation in a technical and economical way; many users need data sharing; and business processes need trust in transactions.

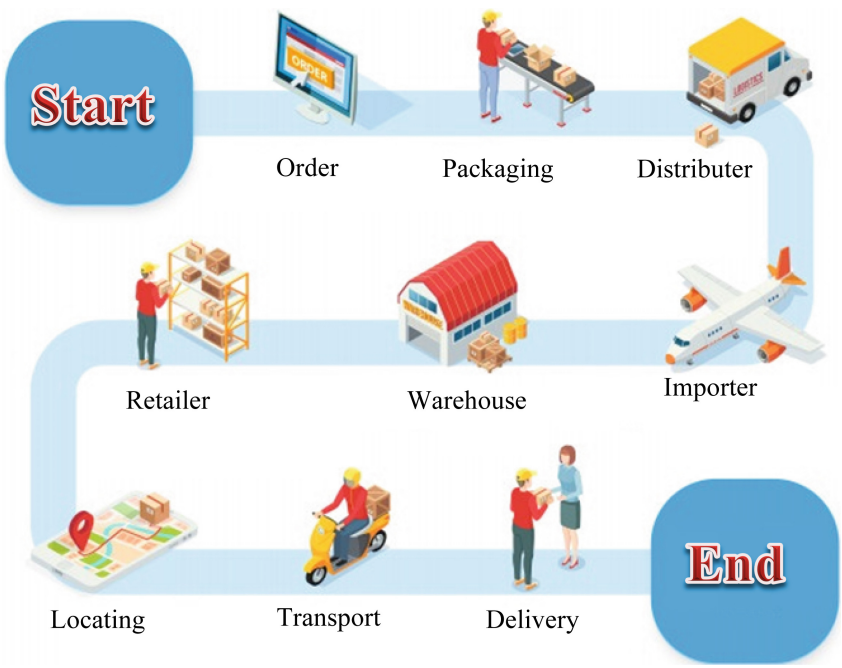

Fig. 2. Product journey

Furthermore, there are five best BBMs that are [10]:

1. Blockchain as a Service (BaaS) which is the most popular business model;
2. Utility token business model which involves driving the functionality in business through the use of tokens, such as Ripple and Stellar;
3. Blockchain-based software products, where any business should buy and integrate a blockchain solution, such as MediaChain from Spotify;
4. Blockchain professional services;
5. Peer-to-peer (P2P) blockchain business model.

3 Proposed Blockchain Business Model

3.1 Stakeholders and Information Flow

Figure 3 shows the stakeholders of the proposed blockchain business model, in which blockchain is a backbone acting as the single source of truth. On one side there is the business as usual showing the flow of goods from the factory to the consumers through distributers. On the other side is the representative of bureaucracy such as the ministry of industry and the chamber of commerce.

Figure 3 also shows the information flow. The factory can publish production details such as location, time and quantity. Distributers can publish shipped product details

while in transit. Both warehouse and retailers can publish store details. Consumers can publish anonymous feedback on the products.

Figure 3 shows vehicle supply chain with arbitrary bar codes. A factory may use Global Location Number (GLN) to identify a location of products. An exporter/importer can use Serial Shipping Container Code (SSCC) to identify logistics units. A warehouse

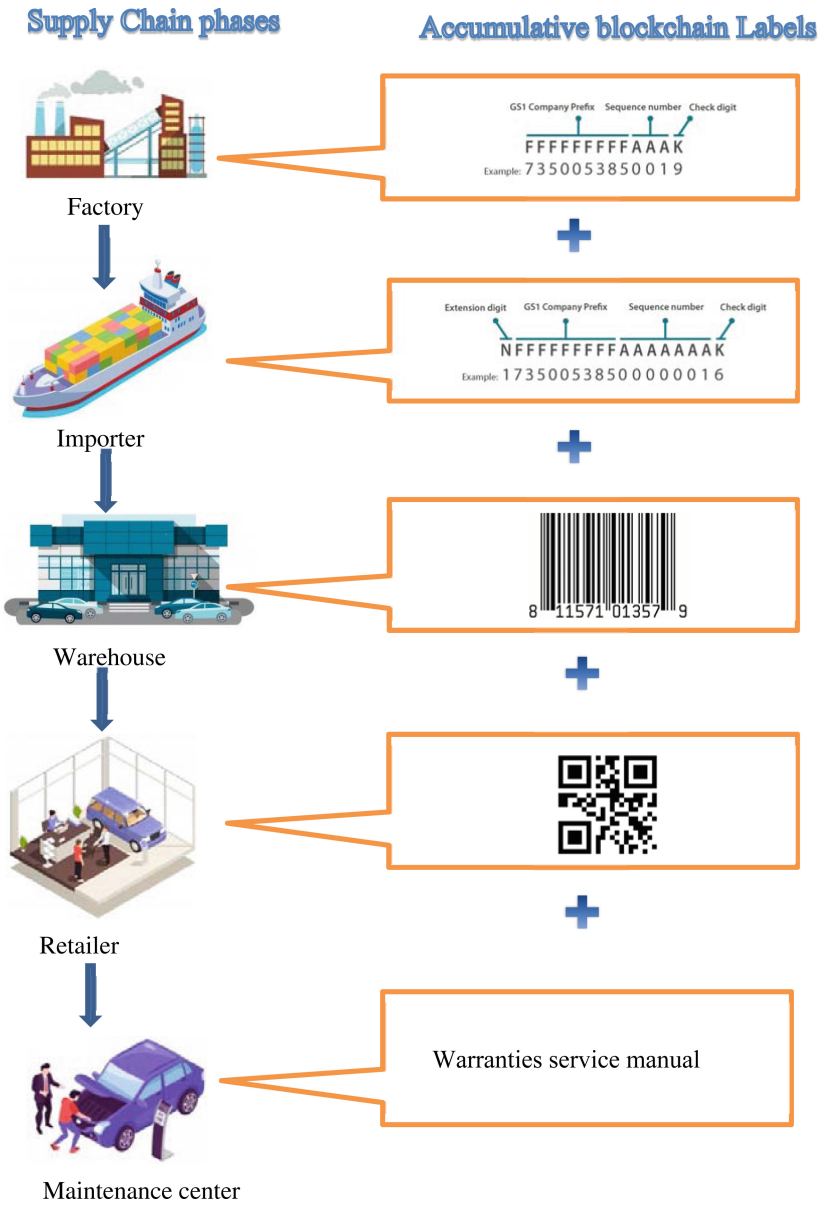

Fig. 3. Vehicle supply chain with accumulative blockchain bar codes

can use Universal Product Code (UPC) usually in USA. The Japanese version of UPC is Japanese Article Numbering (JAN), while the European version is European Article Numbering (EAN). Finally, the retailer may use QR code.

Mining blockchain for consumers is composed of accumulative blockchains of all the factory, importer, warehouse and retailer.

3.2 Mathematical Model

The owner and curator of the blockchain is "Gov" which keeps track of all transactions of products. The key activities are adding and validating blocks. A factory "F" can add blocks regarding the production of product "P". Then, an importer "I" can add blocks regarding the importing process of the product "P". Then, a warehouse "W" can add blocks regarding the warehousing process of the product "P". Finally, a retailer "R" can add blocks regarding the retailing, selling, and reselling process of the product "P".

This can be modeled as shown in Eq. 1:

$$\text{Gov} \leftarrow \text{R}(\text{W}(\text{I}(\text{F}(\text{P})))) \tag{1}$$

This can be easily implemented as aggregation in any object-oriented programming language such as Java.

Any block contains a data "D", and a hash "H". The data accumulates all product data and labels.

3.3 Proposed Blockchain Business Model (BBM)

Figure 4 shows proposed blockchain business model depicted as a business model canvas. The key partners are internet service providers. The key activities are adding and validating blocks. The value propositions are tracking products from production to delivery.

The customer relationships are mainly for warranties. The targeted customer segments are any customer having access to the Internet. The cost structure is mainly for blockchain server operation and Internet access. Revenue streams are mainly taxes.

3.4 Blockchain Structure Implementation

Implementation of the blockchain means blockchain mining procedure. The private blockchain implementation can be later extended into another blockchain type. This is an acceptable limitation to build a prototype that is programmed by using Java language.

Figure 5 shows Graphical User Interface (GUI). Product form, for instance, encapsulates product details which are: ID, name, type, price, manufacturer, bar code, quantity, production date, and expiry.

<table>
<tr>
<td rowspan="2">Key Partners

Ministry of Industry, Chamber of Commerce

Factory, importer, warehouse and retailer</td>
<td>Key Activities

Mining, reading and validating blocks</td>
<td rowspan="2">Value Propo-sitions

Tracking products from production to delivery

Post-delivery services</td>
<td>Customer Relation-ships

Warranties and Satisfaction feedback</td>
<td rowspan="2">Customer Segments

Internet-based customer</td>
</tr>
<tr>
<td>Resources
Blockchain
Databases and servers</td>
<td>Channels
Internet service providers</td>
</tr>
<tr>
<td colspan="3">Cost Structure
• Blockchain server operation
• Blockchain mining cost
• Internet access</td>
<td colspan="2">Revenue Streams
Fees for the services
Taxes</td>
</tr>
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Fig. 4. Proposed blockchain business model canvas

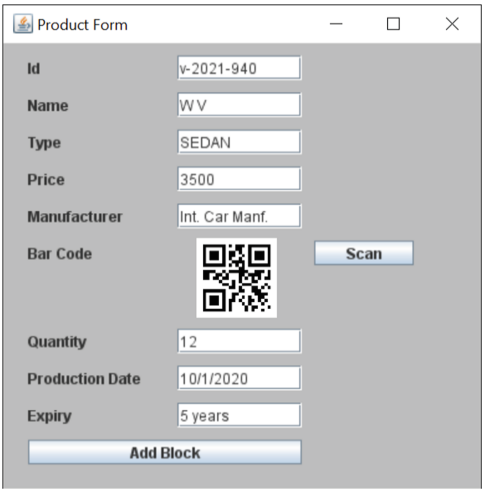

Fig. 5. A prototype of supply chain GUI (Product Form)

Figure 6 shows blockchain structure. It composes all supply chain phases as shown in Fig. 3. At the first run, the genesis block is created. Adding any subsequent block that encapsulates the data shall generate a hash to the previous block.

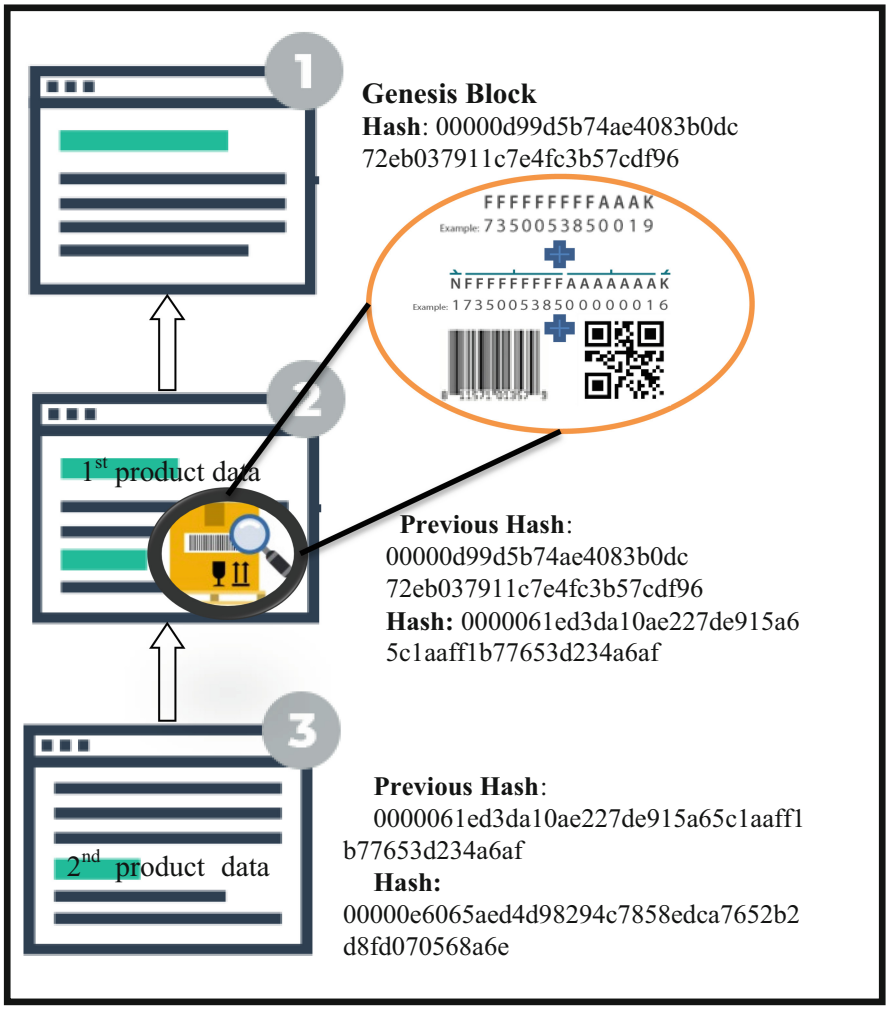

Fig. 6. Blockchain structure mining

3.5 Comparing Proposed BBM with Traditional Supply Chain

Figure 6 shows blockchain structure mining. It composes all supply chain phases. At the first run, the genesis block is created. Adding any subsequent block that encapsulates the data shall generate a hash to the previous block.

Table 1 shows an observed comparison between proposed BBM with traditional supply chain. Traditional supply chain has loose integration and separated phases, while proposed work is accumulative. Proposed BBM is verifiable, easily to trace, and transparent. Proposed BBM has no over price from black market. It can also eliminate brokers. Table 2 shows hash and time of creating 10 blocks for 10 products (vehicles).

Table 1. Comparison between proposed BBM with traditional supply chain.

Aspect	Traditional supply chain	Proposed BBM
Integration	Loose integration	Tight integration
Phases	Separated phases	Accumulative
Verifiability	Non-verifiable	Verifiable
Tracing	Needs effort to trace	Easy to trace
Transparency	No transparency	Transparent
Price	Over price	No over price
Broker	Brokers found	No brokers

Table 2. Hash, time (in nanoseconds) of creating 10 blocks for 10 products (vehicle data).

Block	Hash	Time
Genesis	00000d99d5b74ae4083b0dc72eb037911c7e4fc3b57cdf96	897281524
1	0000061ed3da10ae227de915a65c1aaff1b77653d234a6af	21908751754
2	00000e6065aed4d98294c7858edca7652b2d8fd070568a6e	39943522060
3	0000077d8138ec359b329597b4b0fefecd416bc1745f718b	4687554783
4	000008e389fd736f507fac5150befa0add1c329eb0d344e6	26650053492
5	00000415fa85279deb717159c0891989d80748b0833dbe9d	10545790901
6	000007dfea04c9b44719753d8c3342f557c1499f8e32ea85	44904216538
7	0000069537fa7bd97875936b31157f5daee6ce89b780854a	15871547062
8	000004df9037cf9b31300d7f5ee7e2e621757454db6c7494	15934173508
9	000002f135aa78738578d6640a28bb18bcc8f1d339ae9eeb	33368280209
10	00000e5ce98a36e3ed9b861b7e67c4dce28adb6d794efdef	9031627590

4 Conclusion and Future Directions

A blockchain business model (BBM) that regulates the life of the consumer with a government unit is proposed which can be used to preserve consumer rights and customer satisfaction feedback. The paper proposed a prototype design of a business model that eliminates consumer rights issues by using blockchain. After applying the proposed model, interactions are verifiable and transparent.

In the future, many directions may focus on enhancing the security of the proposed model. Another possible direction is to integrate tokens in the implementation. Another direction may consider measuring supply chain performance [11–14]. Another direction may be considering security of blockchain [15].

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