Re-engineering Countermeasures of the Industrial Chain Model Based on the Block Chain Technology

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Abstract. The transformation & upgrade of the industry is an inevitable trend when it has been evolved to a certain stage of the economic society. In this new trend, the full coordination of the different sections in the industrial chain concerns much to the successful industrial upgrade. The block chain, with its high integration of the data, transmission, precision and its high security, can do many benefits to the industrial upgrade. How is the industrial chain re-engineered by way of the block chain technology? It’s worthwhile to be studied. Therefore, the paper first disentangles the traditional industrial chain and analyzes its problems to be solved in the transformation & upgrade of the industry, then explores the new trend of the industrial transformation & upgrade in the new economic situation, and finally proposes some countermeasures to re-engineer the traditional industrial chain model based on the block chain technology.

1. Introduction

With the gradual application in the economic society, the block chain has been playing more and more roles to the business field such as finance, artificial intelligence, logistics and so on. In essence, the block chain is a shared data bank in which the data or information can be traced and transparent and can’t be falsified and so on. Its core technologies consist of distributed accounts, public-key cryptography, consensus mechanism and intelligent contract. The industrial transformation & upgrade aims at making the production style of high inputs, high consumption and high pollution transformed into that of low inputs, low consumption and low pollution by way of integrating the new generation information technology, intelligence and new energy and new materials, etc into its processing, marketing, logistics and management. The block chain, with its special technological bases, can lay a fond trust foundation for the cooperative parties in the industrial chain. Among its various technologies, the intelligent contract and the consensus mechanism, internet of things, etc are the keys to the industrial transformation & upgrade. So, full integration of the block chain technology into the industrial chain is quite essential to the success of the upgrade.

2. Traditional Industrial Chain Model

2.1. Connotation of the industrial chain

The industrial chain refers to a correlative state formed based on certain technological and economic relationship in the light of logic layout in space and time. It comprises of series of chains like value, businesses, supply & demand and space. It is a dynamic exchange process accompanied with such flows as information, funds, personnel and logistics before the realization of the value among the up-stream and down-stream of the different industries. Broadly speaking, it consists of such sections as manufacturing, supplying, R&D, marketing, etc. Its essence lies in the creation and realization of the
industrial value by way of the correlations among the various businesses. By analyzing the industrial chain, we can identify from which section the value comes from and then input the resources into where they should be invested. In the effective coordination among the various sections of the industrial chain, the target that the productivity of the whole industrial chain is much larger than the sum of the productivity from the inner businesses while the correspondent cost is much lower.

2.2. Model and features of the traditional industrial chain
Integration is the main path of the traditional industrial chain. Generally speaking, the integration may be horizontal, longitudinal and mixed. Its essence is a process of adjusting and coordinating the various sections of the industrial chain so as to raise the operational efficiency of the whole chain and strengthen the competitiveness of the enterprise. The horizontal integration model aims at increasing the concentration of the enterprise, expanding the market and consolidating the control to the market price for the purpose of the higher profit by restraining the same type of the businesses in the industrial chain. The longitudinal integration model aims at maximizing the industrial profit by signing the contract with the enterprises in the upstream & downstream of the industrial chain in order to control the outcome or price. The mixed integration model means integrating or restraining the enterprise that has close relationship with the industry so that the target in profit or market or else may be reached. During the integration, the approach such as mergers & acquisitions, separation or strategic alliance may be adopted.

The traditional industrial chain has the following features: purpose, division of labor and space coordination. The purpose refers to the pursuit of such advantages as resources or labor forces or special geographic location, on the base of which various industrial clusters are formed. The division of labor means that the region with different resources like funds, natural resources, technology and skilled personnel plays a different role in the operation of the whole industrial chain. Commonly, The region with less technological content and fewer funds is usually engaged in the economic activities like resource extraction, labor intensiveness while that with more technological content and funds does the economic activities like deep or fine processing. The former often gets lower added value and the latter enjoys the higher added value. The space coordination means that various industrial clusters in the industrial chain do the correlative business activities so as to maximize their own benefits. Considering that the different industrial clusters are scattered in space, the various sections in the industrial chain are arranged to the specific locations with specific advantages for the aim of acquiring the location benefit. In this way, some larger economic zones or belts which almost hold all the industrial sections appear and the correspondent coordinated benefits such as low cost, high returns and emerging market, etc are produced[1].

2.3. Trends to develop the traditional industrial chain under the new economic situation
In recent years, the traditional industrial chain has been changing a lot. First, the manufacturing industry of the developed country returns to its motherland so as to regain the concerned initiative relative to the intelligent or high-end making in the artificial intelligence, biological technology and new energy,etc and also that of the developing country is being transformed and upgraded for the purpose of getting more added value in the section of deep and fine processing. Then, the global value chain becomes a new way of the international division of labor. Namely, the international division of labor is done inside the industry instead of inter-industries. The productive elements can be arranged in the globe and all the sections of the industrial chain are segmented at their utmost. The value of an outcome may come from different countries since the sections of the industrial chain lie in various countries or regions[2]. Under this new economic situation, whether the industry of a nation or region can be integrated into the global productive system and upgrade its technology or not depends on its competitive advantages in the aspect of core technology and business models,etc. These core technology and business models concern intelligent making, block chain technology, internet of things, supply chain management and digital asset trade and so on. Currently, the development and application of the block chain technology in the industry is providing the new chances for the further evolution of cloud computation, big data and mobile internet,etc. New rounds of technological innovation and industrial revolution are being triggered.
3. Re-engineering Countermeasures of the Industrial Chain Model Based on the Block Chain

3.1. Block chain, its use and potential effects on the industrial chain

The block chain, as an integrated use of distributive data storage, point-to-point transmission, commonly identical mechanism and encryption computation, etc is an intact system (see the following Figure 1) including public chain, alliance chain and special chain based on different application conditions and design style. The public chain may be in and out freely without any point restrictions or centralized service point. All the sections of the alliance chain are matched with correspondent body organization which are the stakeholders able to commonly assure the normal operation of the block chain. Anyone that hasn’t been authorized can’t join in or exit from the network. The special chain belongs to some special body and its authority is controlled inside the special organization. Although it is a universal structure of the multiple points of the block chain, it only adapts to managing and auditing the inside data of the proper body. The core of the block chain is the open source software technology, which can be combined with the big data, cloud computing and artificial intelligence so as to provide the support for the business activities such as internet, logistics and finance, etc. With the support of this technology, various decentralized block chain network can be connected to maximize the functions and commercialized value of the relative participants, because its application can solve such problems as proof complication, high costs, data transmission error and long course and so forth that have commonly existed in the transaction.

![Figure 1. Infrastructure System of the Block Chain.](image)

The application of the block chain will leave a deep effect on the industrial chain. Concretely, the influence may be reflected as follows: first, its feature impossible to be modified can reform the existent centralized credit creation style that make enter into the times of machine trust from the individual and institutional trust[3], for example, the notarization relative to the business can be done in the block chain. Then, its function of the value transfer may help the industrial chain realize its value delivery in the various sections among or inside the block chain. Next, its setup rule of the artificial intelligent contract can effectively control the realization of each transaction by triggering the operation of the intelligent agreement. That’s to say, only the transaction that can satisfy the preset conditions may be carried out without obstacle. Now, the use of the block chain in the field of investment is a good case.
3.2. Re-engineering countermeasures of the industrial chain model based on the block chain

One of the trends to develop the industrial chain is the synergy innovation in technology, financing and intellectual property among the correlative enterprises. However, some problems like innovative power, credit sharing, service framework and industrial supervision, etc., existing in the synergy innovation of the industrial chain are urgently to be solved[4]. The application of the block chain in the industry may further consolidate the intelligence and network. Its machine trust and preset intelligent contract will push the credit sharing of the industrial chain and strengthen the self-supervision online of all the business activities.

Currently, the block chain has been used in some fields like artificial making, supply chain, internet of things and digital asset trade, etc. To integrate the concerned technology into the existent industrial chain, we should make full considerations of the following aspects: which sections of the existent industrial has been using the technology of the block chain? How to combine these sections with those of the existent industrial chain to apply the technology of the block chain?

The complete industrial chain generally consists of various sections or business correlative clusters based on the core technology or process for the purpose of providing some use value for the consumer. The framework of the industrial chain includes connective chain and extensive chain. The former means a cooperative linkage in somewhat form among the interrupt industrial sections in a certain region while the latter refers to expanding the existent industrial chain into its upstream like pieces, raw materials and R&D, etc., or downstream like marketing or selling. Briefly speaking, an overall industrial chain includes such business clusters as suppliers, transporters, warehouse, manufacturers, sellers and all the other productive service providers like financing, consultation and so forth[5]. The interruption or non-coordination of the industrial chain may lead to a loss of the concerned resources. Now the technology has been used in the intelligent making, supply chain and internet of things. The target of the manufacturing industry transformation & upgrade is the industrial intelligence and information. Therefore, to raise the efficiency and effectiveness of the overall industrial chain, it is quite necessary to strengthen the synergy effects of using the technology of the block chain. The correspondent countermeasures are presented as follows:

First, the industrial public chain should be built, of the real value lies in combining the block chain with the industrial chain[6]. Now, since the block chain technology has been penetrating the fields like supply chain, intelligent making, etc., by the industrial public chain set up, we can accelerate the favorable interaction among the productive service sectors such as financing, logistics and internet of things, etc., and the economic entity so that the problems happening in the production and use of the product may be spotted and solved in time by way of dating back to their root in the block chain. In this way, the responsibility of the problems occurred can be easily identified, which may do benefits to cutting down the non-productive cost.

Then, further improve the governance rules of the block chain based on the industry. Overall, they consist of two aspects[7]. One is the technological rules including software, agreement, program, algorithm and the relative installations, etc. The other refers to these regulations of the supervision outside the technology including laws, provisions and industrial policies and so on. This complete system should be joined by the supervision organization, the commercial body and the business entity and so forth. These organizations can be allied and mutually beneficial and push the industrial business forward on the base of the block chain. Also, the block chain technology may be enriched due to being integrated into the concrete industry or sectors. To join in this allied system in the legal form, the concerned organization must be identified, qualified, assessed and contributed to the alliance and obeyed the common constitutions so as to share the correspondent technological progress outcome.

Next, in the transformation and upgrade of digitizing and intelligence of the industry, the block chain technology may be applied to a greater degree. Up to now, the core technology of the block chain includes distributive data storage, point-to-point transmission, common identification mechanism and encryption algorithm, etc. These technologies can do much good to the breakthrough of the industrial transformation & upgrade if integrated into the industry[8]. Take the following for example: its unchangeable, massive data sets including the whole history of each transaction successively enlarges the data size and enriches the data content with the different business blocks, too[9]. In spite of its relative weak capacity of the data statistic analysis, the combination with the big data analytical
technology can much increase its value and expand its application. These core technologies of the block chain can assure its trustworthiness, security and trace-ability of the data from collection, transaction, circulation and computing of every business activity since their records can be precisely kept in the block chain. Also, the block chain has the function of further normalizing the data application and making the authorization more precise. The flow of the transaction data after the desensitization in the block chain is helpful to constructing the crosswise circulation mechanism and the value transferring system based on the block and then further push the digital exchange in the global industrial chain.

What’s more, the features owned by the block chain such as the securities in the data recorded, data available and the anti-attack due to its distributive refusal service system(DDOS) can prevent the other core data in the industrial chain from being falsified or grabbed. Although it has these advantages in the security, the block chain faces some risks in the concrete sections like the public chain, privacy and algorithm, etc. Considering these disadvantages, we should formulate the relative risk control mechanism to supervise severely the data visit and transaction frequency in the network, main equipment and application system in setting up the industrial block chain. If illegal operation is spotted, the remedy in the technology and business, etc must be dealt with immediately from its root so as to put an end to another attack. Any suspicious act ought to be alerted, recorded and verified at once. Some measures should be adopted in the following aspects[10]. First, the network and the main machine to operate the industrial block chain must be always protected besides VPN, firewall and certain physical isolation and so forth. Second, the data to be uploaded into the network should be assessed beforehand in the sensitive degree and security level to see if they are suitable to be opened. Also, the data exchange between the different sections of the industrial block chain like suppliers and makers and dealers, etc can be coded confidentially asymmetrically by consultation or encoded and decoded by the symmetrical algorithm. Besides, the secrete key whether in the communication data or the stock data in the different points of the industrial block chain must be kept safely and shouldn’t appear in the same section point. Once lost or disclosed, the system may identify the relative records of the original key and make it invalid as soon as possible. And the secrete key must be managed dynamically. In the application system, the stakeholders who join in the activities of the transaction points and data must be controlled before the activity and verified after the activity in the identity authentication, accessibility, transaction rules and anti-fraud, etc.

4. Conclusion

Whether the industrial transformation & upgrade succeeds or not concerns the sustainable development of the industry. The block chain technology, as a new generation of the information network technology, will speed up the success of the industrial transformation & upgrade. Also, it can induce the birth of some emerging industries. These new economic changes bring the chance to the further industrial development and also require that the traditional industry should remodel itself to capture the opportunity to upgrade itself. Only in this way can the industry be suitable for the changing technological and operational environment.

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