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A Conceptual Model of a B2B Food Distribution Platform Based on Blockchain Consensus Mechanism

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Abstract: *We proposed a B2B food distribution platform by transforming an established food distribution and management platform based on blockchain technology. Our proposed model introduced a method to bring innovation into the domestic B2B food distribution market and systematically manage and utilize massive data (country of origin, producer, transaction, distributor, final consumer) generated within the food distribution process.*

Keywords: Blockchain technology; Food distribution; Digital transformation; Cryptocurrency; Application prospects

1. Introduction

People of modern society due to their busy lives have increased their rates of dining out and consuming processed food. As a result, the business-to-business (hereafter referred to as B2B) food distribution market has rapidly grown over time. Despite these developments, the domestic B2B food distribution market has been mostly dependent on offline transactions by small or medium-sized companies, leaving most of the transaction data has remained unused [1].

Through blockchain technology, our proposed model collects and manages food transaction information, which is made available to participants wishing to use such information, and seeks to alleviate information asymmetry, reduce the unnecessary middle distribution process in the food distribution value chain, and ultimately resolve the issues of the traditional distribution method.

Our model employs a transformation of an established food distribution management platform based on blockchain technology. Our model is designed to launch a service leveraging the initial users, data, and know-how available through the services provided by the established distribution management platform, and through which, will have a substantial competitive edge by being able to avoid trial-and-error phases commonly encountered by most blockchain projects in their market entry stage. In addition, our model aims to support data market and establish a compensation mechanism for the data provided by participants. By publicizing food transaction information through the platform, it enables (i) use of transaction data as big data for prediction and analytics, and (ii) provision of additional services to participants in addition to basic food supply transactions through decentralized applications (hereafter referred to as dApps) developed by partners using such transaction data. Furthermore, by providing information regarding the credibility of both domestic and foreign platform participants, our proposed model can be later expanded for international trade.

Our proposed model is composed of: (i) the online B2B Marketplace, (ii) the established food distribution management platform, (iii) public transaction ledger, (iv) foundational technology of a private blockchain, and (v) dApps provided by partners. These components each have their own characteristics, and through mutual interaction, they ultimately serve the role of making B2B food distribution transactions more convenient, safe, and efficient to participants.

When taking a detailed look at the function of each component: (i) The online B2B Marketplace is a distribution platform that connects online/offline transactions. When a seller registers its product and transaction terms on this B2B Marketplace (including information such as, product characteristics, unit price, etc.) the buyer

can purchase the product from the seller after reviewing delivery conditions, seller reviews, and other information on the marketplace. Through this process, distributors are able to obtain information regarding the buyers to secure potential customers, and sellers are able to supply their products under optimal conditions to meet demand by taking into consideration the preferred country of origin, price, and quantity for the buyers, effectively resolving the unstable supply and demand issue of the current distribution market. (ii) In order to mediate such transactions between participants, our proposed model depends on the established food distribution management platform. Currently in distribution transactions, the seller typically uses enterprise resource planning (hereafter referred to as ERP) systems, but such ERP systems are inefficient as it unnecessarily requires the time and effort of the seller to individually input all transaction details into the system. Based on the transformation of the established food distribution management platform, however, the seller will be able to process transactions online and easily convert offline transactions into digital data for storage. (iii) Our proposed model allows for data to be publicized by anonymizing certain parts of food transaction data within the platform. Participants will be able to use the publicly available data from the public transaction ledger to determine their own distribution methods that maximize their utility. (iv) By using the technology of a private blockchain, it will enhance platform operational efficiency and strengthen personal information protection and security. (v) Through the use of various dApps, it will be able to provide an even greater variety of innovative services to platform participants.

Within our model, the first type of cryptocurrency, which has high short-term price stability, is used as a medium of exchange for food-related transactions, and the second type of cryptocurrency, which can be used for various purposes, is issued and used as a medium of exchange for other related services available in the online B2B Marketplace. These cryptocurrencies differ in terms of acquisition method, use and benefits, and price determination methods, but they can ultimately be exchanged into Ethereum through smart contracts. The participants contributing to the online B2B Marketplace are compensated with the second type of cryptocurrency based on the nature and degree of their contributions, and such compensation will become a key driver in further improving and developing the platform by expanding the current contributions and attracting new participants. This paper provides details of the proposed model and its coin economy and presents how it alleviates inefficiencies prevalent in the traditional distribution method.

2. Background

2.1. Overview of the B2B food distribution market

Food supplies mean the necessary ingredients used to create dishes. The buyers of food supplies are those who desire to create such dishes, and they can be largely categorized into (i) general (end) consumers purchasing to consume food, and (ii) businesses, including restaurants and food-related companies, that create and sell food.

In the case of food supply sales to general consumers, the competition among general distributors has been fierce, and although the size of food supply transactions is large in the aggregate, it is very small and unpredictable for each individual consumer [2-4]. On the other hand, in the case of businesses that manufacture and sell food, transactions are large per business with stable demand, creating comparatively greater opportunities to generate additional value through distribution [5-7].

Our proposed model is particularly ideal for the B2B food distribution market, which focuses on food distribution to businesses such as restaurants and food-related enterprises. Primarily, it may focus on the domestic market in its early stage, but later, can expand its business to the international food distribution market.

2.2. Market size and growth potential

2.2.1. Growth to the global food and dining industry

The dining industry has continued to grow around the world as a result of (i) structural factors, including economic growth, changes in population structure, increase in wages, and increase in income, and (ii) sociocultural factors, including healthy consumption, conspicuous consumption, and eco-friendly consumption [8-12].

As of 2015, the global food market size increased by 3.6% compared to the previous year to USD 6.352 trillion, which was a result of an annual 3.2% growth over the past 5 years, and should this growth rate continue, the market is expected to exceed USD 7 trillion in 3 years [13]. This is approximately 4.7 times the size of the

global automobile market (USD 1.3 trillion), 6.9 times the size of the global IT market (USD 900 billion), and 8.4 times the size of the global steel market (USD 700 billion) [14].

By region, the APAC region has been growing at an annual growth rate of 5.9%, driven by the economic growth of China, and by country, China and the US were the largest markets, each with a market size of USD 1.2 trillion, followed by Japan (USD 400 billion) and Germany (USD 300 billion) [15-16].

2.2.2. Stable growth of market leader

SYSCO, the dominant leader in the US food distribution market, has been improving its productivity through food distribution-related systems and process innovation [17]. In particular, in the case of Korea, the size of the food/dining industry exceeded KRW 200 trillion as of 2016 [18], and the number of dining-related companies have been continuing to dramatically increase. As a result, revenue has been continuously growing while also sustaining a high and stable operating margin. If such data is to be used in the food market, it will be possible to achieve a significantly high level of operating income.

2.3. Market entry and growth opportunities

2.3.1. Inefficiency of the existing market

First, most food supplies are provided by small and medium-sized businesses. In the case of Korean domestic food distribution market, the volume distributed by small and medium-sized businesses account for approximately 85% [19]. Small and medium-sized businesses have grown based on their own unique advantages, including (i) expertise in specific product categories, (ii) network with restaurants in the region, and (iii) response to sudden orders and claims. However, because of the high proportion of credit transactions in the market by small and medium-sized businesses, there is a potential risk arising from overall market dependence on credit [20].

Second, excessive costs are incurred due to an overcomplicated distribution structure with an excessive presence of middle distribution companies. In the case of food distribution in Korean domestic market, the excessive number of distribution companies involved resulting from an overcomplicated distribution structure. As a result, the distribution cost incurred from the point the food supply is manufactured to the point it is consumed is on average 44.5% of the manufacturing cost, resulting in unnecessary costs being transferred to consumers and independent businessmen in Korea [21]. Note that the inefficiency of the food distribution market is not only prevalent in Korea but is widely witnessed in many countries around the globe [22].

2.3.2. Unmet needs of food suppliers and purchasers

First, parties, such as restaurants, that want to purchase food supplies desire to have information on the various food suppliers and their transaction terms. Yet, such information is not only widely available, but also extremely difficult to access. Aside from large-scale franchises, small size dining businesses face difficulty in obtaining information from their food suppliers, and even if they have such information, it is difficult for them to contact these suppliers and purchase food supplies. Ultimately, small size dining businesses end up securing their food supplies through secondary wholesalers or retailers, rather than from the producers or the primary wholesalers, using (i) the personal networks of the chef or other employees, or (ii) the networks of other dining businesses [23]. In particular, most food supply distributors, including producers, primary wholesalers, and secondary wholesalers, conduct their businesses offline rather than online, due to their small business scale, resulting in a lack of need for websites and other online marketing channels. As such, due to the lack of information on food suppliers and distributors, it is practically impossible for small size dining businesses be in a position to compare and choose their products based on price, quality, and characteristics, and as a result, this serves as an impediment in increasing the price and quality competitiveness of the food provided by these dining companies.

Second, some large-scale distributors monopolize various types of information regarding not only food suppliers, but also the food distribution chain. In order to efficiently trade food supplies, information regarding food supplies must be transparently shared among the producer, distributor, and buyer [24]. However, key information, such as production cost, profit margin, and production quantity are hoarded and managed by few large-scale distributors, and the remaining participants are left to carry out transactions without the benefit of such information. This information asymmetry results in adverse effects, such as the failure to predict food

supply demand or spikes or decline in prices, through which large-scale distributors continue to profit, making it difficult to change the status quo.

As a result of the aforementioned issues, most food supply purchasers carry out food supply transactions based on their experience and intuition, with no objective rationale for such decisions due to the lack of information, resulting in unnecessary damages and costs. As we have explained above, because transaction data is not transparent and is used for the benefit of specific parties, it is difficult to carry out purchases using existing transaction data. Ultimately, the counterparties are left to carry out transactions offline with no existing transaction information, using their own experience as the basis to determine the credibility of the counterparty and quality of the food supplies as they are unable to use the previous transaction data of the counterparty. Therefore, parties must incur significant transaction costs if they seek out a new transaction counterparty, and, accordingly, the market remains inefficient.

2.3.3. Introduction of technological method for issue resolution

In order to resolve such issues in the domestic B2B food distribution market, the market needs a method that can be used to systematically manage and utilize the massive data (country of origin, producer, transaction, distributor, final consumer) generated within the food distribution process. With the development of IT technology, including blockchain technology, it has become possible to resolve significant aspects of the issues described above through technological means.

Based on such technological advancements, our proposed model introduces a method to bring innovation into the domestic B2B food distribution market. Through a blockchain transformation of the established food distribution management platform, necessary information can be shared transparently, and moreover, the food transaction data itself can be traded and utilized within the market. Note such aspects are not found in existing B2B food distribution platform. Later sections provide greater detail on our proposed model.

3. Blockchain transformation of an existing platform

3.1. Expected impact from the use of an established platform and blockchain transformation

Issues regarding the food distribution market are well-known, and as a result, there have been countless attempts in the past to implement and apply blockchain technologies to the area of distribution. However, in order to apply the blockchain technology, platform participants must invest significant efforts, including continuously inputting and verifying information arising from the entire distribution process, but due to the difficulty in inducing such efforts from the participants, it has been difficult to obtain meaningful results.

Furthermore, in the case of projects that rely only on new blockchain technologies and apply them to distribution, logistics, and supply chain management (SCM), the participants active in the dining and distribution industries are not familiar with or do not understand blockchain technology or blockchain platforms and they hardly find the cryptocurrency compensation scheme attractive.

Through data mining of digital transaction data arising from online/offline transactions collected and verified through an established distribution platform, the proposed model aims to mutually link such data to produce meaningful data for the development and servicing of our online B2B Market place.

As such, our model does not propose a completely new project, but rather a blockchain transformation project that is an improvement/extension to an established B2B food distribution management platform. Our proposition possesses a significant advantage as a service platform that can naturally apply blockchain technology while requiring no need for any additional learning or adaptation activities for the distributor or buyer. The online B2B marketplace is operated through blockchains, but the actual participants will not know that the service is operated through blockchains and will experience the same convenience they are accustomed to when using the established food distribution management platform. This is made possible through the solid technical capabilities based on its experience in various e-commerce.

The advantage in being able to leverage the past track-record of the established food distribution management platform will serve as a powerful tool in overcoming difficulties encountered in other projects. Should the proposed model become activated, it will drastically reduce and improve the overly complicated food distribution value chain, and the participants will be able to utilize the abundant data to select optimal transactions and carry out payments and settlements through a simplified and transparent method.

3.2. Provision of data market for transactions based on “food transaction data”

As mentioned previously, the various data generated in food transactions, such as production cost, profit margin, and production volume, carry enormous value as the basis for predictions to the food distribution market in the future. In particular, the recent development of big data analytics technologies has allowed for more accurate and detailed analytics and predictions, but this has required the collection of massive amounts of data.

However, excluding a few of the large-scale distributors, most food supply buyers, suppliers, and distributors lack in both the quantity and quality of data to conduct big data analytics or other meaningful analysis and predictions. Such issues may be resolved through the process of compiling and sharing the information held by the various parties, but because there were no incentives for them to provide such data, no meaningful data sharing attempts had been made until now.

By introducing a cryptocurrency that can be used as a means of compensation for providing information within the platform, the proposed model incentivizes users to provide their various food transaction data to the market in return. It is expected that the main buyer for the data market will be companies desiring to analyze the impact of their advertisement or marketing activities, food producers considering contract farming, or large-scale food supply and food producers and distributors. The following list is an example of the additional value created using data on the model.

1. Demand prediction and the efficient determination, production, and securing of production/manufacturing/importing quantity based on such insight through existing transaction data
2. Online/offline promotion and provision of marketing channels based on transaction data
3. Provision of data API and a compensation system for various distribution companies to participate in the platform
4. Through the principle of “Transaction = Data generation activity,” the profit resulting from the data generated is given back to the data provider as a form of compensation, creating a value-cycle ecosystem

The implementation of such compensation mechanisms is expected to increase the satisfaction and loyalty of participants for the online B2B marketplace. In addition, this will accelerate the inflow of new participants, including conglomerates and other food distribution market players, to the online B2B marketplace, which will in turn improve the quality and quantity of the data collected through the online B2B marketplace and contribute to a virtuous cycle ecosystem that will continue to increase in value.

3.3. Use case

The following are hypothetical cases showing the types of benefits participants of the online B2B food marketplace will be able to receive by using it. In addition to the following cases, participants will be able to receive various services through the B2B food transaction marketplace and dApps.

1. Farm owner Amy has been selling vegetables to a food wholesaler who was introduced to Amy through one of her acquaintances. Although Amy was thinking that the price proposed by the wholesaler was too low, she not only does not know about the transaction terms of other parties, but also finds it difficult to seek out other distributors to replace her current transaction counterparty, and thus, she continues to carry out transactions with no other solution.
   One day, Amy found out about the online B2B food transaction marketplace and participated in the platform as a food supplier, and after inputting basic information on the location of her farm along with the types and quantity of the food produced, she was contacted by dozens of other distributors who were willing to purchase her vegetables. After confirming the detailed transaction conditions and prices of similar vegetables sold by other neighboring farm owners through the online B2B food transaction marketplace, she was able to propose the most satisfactory condition, and as a result, she was able to sell the vegetables to the most trustworthy distributor based on its previous transaction records.
2. Restaurant owner Ben just began a business by opening his first restaurant. The chef is responsible for the procurement of food supplies, but because of the high food supply costs compared to the quality, Ben is suspicious as to whether the chef is receiving rebates from the supplier. However, he

does not have any hard evidence, and should the chef decide to leave his restaurant, he would have to close the restaurant doors until a new chef is hired.

After Ben registered on the online B2B food transaction marketplace, he was able to confirm the delivery price of food suppliers for adjacent restaurants and realized that the chef was procuring food supplies at a price 20% higher than the other restaurants. Thus, Ben quickly began to recruit a new chef and found a trustworthy one through the dApp in a short period of time. Then, Ben pointed out his findings to the chef and notified that the job was terminated.

3. Freight forwarder Chris has been making a living transporting various goods with a small truck. However, (i) his income was not stable due to sporadic transportation work orders, and (ii) he had to pay a hefty commission fee to a broker as his work was dependent on a freight brokerage company, resulting in very low disposable income.

   After Chris joined the online B2B food transaction marketplace, he was able to find information on certain food producers and distributors who were commissioning small-scale food transportation work to external vendors due to the lack of freight transportation capabilities. Because the freight volume and transportation fee suited Chris's needs, Chris decided to contract with these parties to carry out work regularly supplying food supplies to restaurants, resulting in a stable income. Moreover, because the online B2B food transaction marketplace does not have any commission fees, his margin also increased compared to his work through general freight transportation brokerage companies.

4. Conglomerate D, which focuses on food manufacturing and sales, desires to understand the general market demand for corn, which is a key ingredient of a new product it is looking to develop in the future. Although the findings resulting from various assumptions and historic data were inevitably inaccurate, through the online B2B food transaction marketplace, the company is able to compile the most recent transaction data, which greatly improves the accuracy and depth of its predictions. Furthermore, although in the past, there was no method to advertise its newly released product to distributors or restaurants, through the online B2B food transaction marketplace, it is able to carry out targeted marketing and instantaneously measure the impact of advertisement and sales promotion.

4. Key Components and Functions

Our proposed model has the following components: (i) the online B2B marketplace, (ii) an established distribution management platform, (iii) private blockchain, and (iv) open ledger. This composition enables an easy and convenient digital transformation for distribution channels while also maintaining the existing offline distribution method, creating an online distribution market and enabling the expansion of new transactions. Furthermore, the online/offline transaction data generated through the platform will be provided to its partners and participants, which will contribute to the further expansion and development of platform participants and increase revenue for the data providers (both sellers and buyers), which will incentivize the data providers to provide more data.

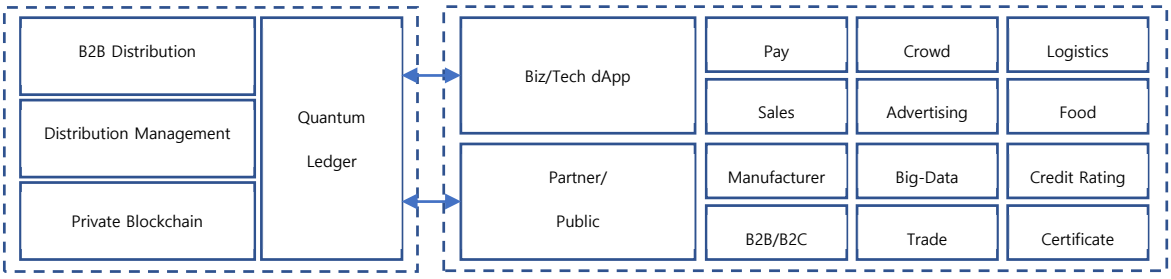

Figure 1. System Architecture

4.1. B2B Marketplace

4.1.1. Overview

The online B2B marketplace is a new distribution channel that connects online/offline transactions. When the seller (producer or distributor) registers its transaction terms (available products, trade volume, sell price, payment conditions, delivery method, etc.) onto the platform, the buyer will be able to select a seller based on

various information (location, trade and delivery conditions, previous transactions and reviews, etc.), providing an online mediation service for the safe transaction of food supplies. The online B2B marketplace provides not only simple online transactions, but also quotation requests, automated orders, regular orders, and bulk purchases (group deal, crowdfunding), enabling offline transaction activities that were not possible with previous online e-commerce platforms to provide a B2B distribution-focused service.

Specifically, within a data-based distribution ecosystem, the online B2B marketplace (i) connects buyers with the optimal sellers through multidimensional analysis of transaction terms, (ii) provides information on costs, payment methods, and delivery methods based on the transaction quantity across all stages of the transaction from wholesale to retail, and (iii) creates a process for buyers within the platform to directly trade food supplies with the producers. In addition, the online B2B marketplace (iv) enables the reduction of logistics and distribution costs for the middle distributor by allowing sellers to create distribution clusters based on the locational and sales data of the buyers, and (v) realize quick and efficient contracting, trading, and payment processing through smart contracts.

4.1.2. Key Function 1: Drastic reduction in transaction counterparty search costs through online transactions

On the online B2B marketplace, when a seller (producer or distributor) registers various transaction conditions (handling goods, transaction size, unit price, payment terms, delivery method, etc.) on the platform, the buyer can consider various information (location, transaction and delivery conditions, previous delivery records and reviews, etc.) to select the appropriate seller for safe food supply transactions.

Through multidimensional analysis of the transaction conditions, the online B2B marketplace not only connects the optimal seller to the buyer, but also provides a process for buyers to directly trade with the producers based on the platform's sales power, providing a method for participating food buyers and sellers to overcome previous limitations in the offline market and seek out transaction counterparties with various transaction terms and significantly reduce search costs.

Moreover, the online B2B marketplace provides information on price, payment method, and delivery method based on transaction volume from wholesale to retail to its participants. Based on such information, participants are able to transparently verify detailed transaction conditions, including specific food supply prices, and proactively use the information when carrying out food transactions.

4.1.3. Key Function 2: Convenient and safe payments

The prevalence of credit transactions in the current offline food B2B market is considered the greatest risk of the existing transaction method. For transactions between suppliers (producers, manufacturers, importers, etc.) and distributors, the supplier first supplies the product to the distributors, and (i) the amount for the product is paid after a certain time period, or (ii) the distributor pays the amount to the seller after the product is sold. Under this structure, delaying payments to financially unstable distributors could threaten the businesses of upstream distributors and suppliers.

To minimize such payment risks, suppliers have (i) discriminated prices according to pre-paid transactions and credit transactions, or (ii) refused to transact with distributors that do not have previous transaction records. This method results in unnecessary costs resulting from distrust even for transaction counterparties that have already established a certain level of trust, and the distribution industry has a relatively higher level of costs resulting from distrust compared to other industries. Such costs ultimately become a cause for an increase in the purchase price for the buyer.

In order to prevent such payment risk and costs arising from distrust, the online B2B marketplace stores the costs and payment amounts throughout the distribution process, including the supply price, distribution margin, and logistics cost, and when the ultimate consumer pays the full amount for the product through the marketplace, each transaction counterparty (supplier and distributor) is paid the appropriate amount directly by the B2B marketplace. In addition, our model resolves the fundamental issue of credit transactions and payment issues through blockchain and smart contracts, providing a quick and efficient way to process contracts, transactions, and payments. Specific resolutions to such issues this will continuously develop through various research and tests throughout the project.

4.2. Established food distribution management platform

4.2.1. Overview

Participants within the online B2B food marketplace who sell food supplies will be able to use the established distribution management service to easily and conveniently process complicated distribution management work, including order processing, inventory, purchase, and settlement.

Currently, sellers generally use complicated and difficult enterprise resource planning (ERP) systems for their offline food supply transactions, and as a result, employees must manually input all transaction data into the ERP. Through this process, human error, such as incorrect inputs, omissions, and delivery errors, frequently occur, making it practically impossible to verify and identify such errors after the fact. As a result, all damages must be borne by the seller. In addition, data generated through offline transactions is generally isolated and saved in the seller's local PC, resulting in the loss of unlimited opportunities to utilize such data. This has been a fundamental issue preventing the expansion of the market and development of the distribution industry.

On the other hand, the established distribution management service allows for easy processing of the necessary work required throughout the food distribution process, including order receipt, inventory, order placement, payment, delivery order, delivery management, and invoice delivery, through either its mobile application or online, and during this process, offline transaction data is naturally converted into digital data and saved. Through the established distribution management service, our proposed model not only collects the seller's transaction information and client information, but also contributes to the increase in revenue for the seller by publicizing the seller's information to the online B2B food marketplace and provides necessary services for the overall management of the seller's online/offline distribution work. Meanwhile, the established distribution management service is later linked with the transaction mediation service.

4.2.2. Key Function 1: Provision of efficient management methods online

As of 2018, the Asia region has been conducting food B2B distributions offline, which does not differ greatly from the businesses conducted in the 1990s prior to the advent of the Internet. Transactions were carried out through verbal arrangements without contracts, invoices were issued on paper, and transaction details were manually input into Excel files or ERP systems in local PCs. Such methods (i) resulted in frequent errors during the data input process, which created confusion related to such transactions, and (ii) made it impossible to track data as the various information generated throughout the production, distribution, and transaction processes were not interconnected, which was a critical disadvantage that made it difficult to identify and resolve various issues arising during the distribution process.

Our proposed model improves on the currently inefficient distribution model conducted offline by converting it into a digital format, and through the provision of a SaaS-based distribution management service and infrastructure, allows for participants to carry out more accurate, convenient, and effective transactions, distribution, and settlement.

4.2.3. Key Function 2: Construction of transaction counterparty data for international trade

With the growth in trade among nations, the global sourcing and commissioned production has grown significantly and is expected to continue to do so over time. However, unlike trades within national boundaries, international commerce poses risks given that it is a complicated business involving the sourcing of credible local products, producers, and brokers, as well as local contracting, foreign exchange transactions, distribution, and customs.

Through the distribution management platform, which has already been validated within a market and will be provided globally, our proposed model allows for the collection and verification of credible producer and distributor information as well as the distribution structure and method and transaction data of various countries. Accordingly, by allowing verified producers and distributors of various countries to use the online B2B Marketplace, our model aims to create an international commerce transaction system that can provide stable services by connecting food-related businesses and reduce costs.

4.2.4. Key Function 3: Tracing and mutual verification of product information

Our model has moved forward from the existing method of providing significant and credible information on the place of origin or components of the products by allowing for cross-checking of pre-verified data from

the initial producers and other buyers after production by storing and linking all transaction data across the distribution process by utilizing blockchain technology. This is a more advanced method than the previous place of origin tracking system as it quantifies the place of origin transaction, distribution volume by each party, product distribution channel, and verification and feedback information provided by each transaction counterparty and provides them to the buyer.

4.3. Public transaction ledger

4.3.1. Overview

The public transaction ledger is comprised of public data within the platform, and it categorizes customer, product, and transaction activity analysis data within the Private Blockchain to provide data to platform participants, including partner companies, dApp operators, and production/distribution corporate clients. The public data can be categorized into the following two types.

1. Anonymized data: The proposed model anonymizes the data of participants, enabling the public use of such data. To accomplish this, the platform obtains the agreement of the participants through basic use policies, terms and conditions, and personal information use guidelines. The model collects and manages information of the participants, including their region, business type, supplier, product, price, quantity, transaction date, transaction method, and payment method, and through data mining and cluster analysis of the collected data, combined data is extracted, improving the credibility of the data and making it impossible to track or make inferences on the identity of the data provider.
2. Data publicized by participants: In order to receive the compensation and benefits offered on the B2B distribution platform, the participants can publish their identity and transaction data. On the one hand, companies can use the B2B distribution platform to utilize and analyze the collected data for customer targeted product advertisements or promotions. Such data-based services will be provided at a fee, and participants who provide their own data will be compensated through coins and other benefits or promotional products provided free-of-charge or at a discounted price. Ultimately, the B2B distribution service will operate as a platform that can benefit both the providers and users of data.

Meanwhile, participants that can access the public transaction ledger can be categorized into the following two groups.

1. Partner companies and dApp service companies: These companies can use the public transaction ledger data through the Restful API, and the data they generate can be saved and shared within our Private Blockchain through the public transaction ledger. These companies can save data only through the proposed model.
2. Large-scale manufacturing/distribution companies: These companies can utilize the public transaction ledger data through the fee-based service provided by its dApp, and through target marketing and promotion-related dApps, they are able to further grow their businesses within the proposed B2B distribution platform. This business model has already been verified through its application in large-scale supermarkets. By using data within the platform, small and medium-sized companies that are scattered offline will be able to efficiently carry out marketing online through the services provided by dApps.

4.3.2. Key Function

Customer and transaction data generated throughout the distribution process is widely used across the business, such as for expanding customer scope, increasing sales, and improving inefficient distribution processes. In the case of large distributors and producers who have established vertical distribution systems, such information has been used to grow and develop their businesses, but since the business areas for such small and medium-size distributors and producers have been limited to a certain extent, it was impossible to collect and manage combined data and was difficult to even imagine they would receive distribution data from a third party.

The proposed model analyzes and refines transaction data generated directly by the platform or flowing through its partners, stores it into the blockchain, and provides it to its participants through a public ledger. The data publicly available through this ledger is then utilized by partners, including dApp operators, who collect

data by developing their businesses both within the platform or externally. Even if a person is not a partner, companies that desire to analyze and select customers, increase revenue, or predict the future of the distribution market are able to freely utilize the data through the proposed B2B distribution platform (this is the business model of Dunnhumby, a UK distribution data analytics company).

In other words, the proposed B2B distribution platform provides a service that generates, collects, verifies, reanalyzes, and publishes a reliable transaction ledger in the field of food distribution. All transaction data generated throughout the distribution process can reduce the distribution value chain, connect credible transactions, and greatly help expand customer base, business regions, and business scope. The proposed model will transform the flow of information in the distribution industry, from its previous unidirectional, vertical structure to a bi-directional, horizontal structure, which will help overcome the limitations of production and manufacturing limited to specific companies, regions, and countries, and moreover, make possible a counterparty-based production and distribution economy rather than focusing on non-capital-based transaction data. In addition, our proposed model will provide the necessary support to enable various participants within the platform to provide transaction data ledgers and verify them, sharing the profits generated with the participants to create a healthy distribution ecosystem.

4.4. Foundational blockchain technology: private blockchain

There are two types of blockchains: public blockchains and private blockchains. For general projects using public blockchains, such as Ethereum and EOS, issues regarding cost and processing speed due to gas costs may occur, and for the proposed B2B distribution platform, which requires massive volumes of data processing power, this issue may become a major obstacle to the growth and development of the platform.

As an alternative to the public blockchain, the private blockchain stores and discloses the details of the product information, contracts, and contract performance results into blocks and rewards the participants who use such blocks. Our model uses symmetric and asymmetric key-based cryptography to secure the integrity and confidentiality of the smart contract data stored in the blocks of the private blockchain. In addition, in order to prevent transaction parties from denying that there was no such agreement, when a block including contract information is created, information records using a digital signature function, public key infrastructure (PKI), and verbose logging is created to accommodate a large amount of data and monitor whether the information is being processed appropriately.

Through a private blockchain existing within the core network, our model carries out quick transaction processing and verification functions for transactions occurring within our platform to resolve the aforementioned issues, and in addition, it is able to achieve its purpose of free data utilization and expansion, strengthening security, and protecting personal privacy. Specifically, the proposed B2B distribution platform stores primary raw data (transaction processing data of less than 1 MB) in its private blockchain within the proposed B2B distribution platform, while other information and images necessary for service provision are processed through a separate database configuration. On the other hand, the private blockchain data maintains its security through anchoring, periodically sharing has values with the public blockchain (a suitable chain for this project will be selected in the future).

4.5. Platform-based dApps

4.5.1. Overview

DApps provided by partners based on the platform are also an important component. Our partners and dApp service partners can utilize the public transaction ledger's data through the REST(Representational State Transfer)ful API provided by the platform, enabling dApps to be able to provide various services to the platform participants by our supply/demand data in various distribution and food-tech areas.

In the case of current offline B2B food distribution transactions, most freight transportation trucks are often operated by individual business owners, who only receive intermittent and one-off transactions from freight companies, are inefficiently allocated cargo transportation work without taking into consideration the cargo type or location.

The proposed B2B distribution platform enables regular transactions between sellers and buyers, enabling the distribution of food supplies and related third party logistics (3PL) services to be carried out separately, so that freight transportation trucks can participate in the process and provide stable and regular transportation

services. For example, if a freight transportation truck owner inputs information on his or her vehicle type, driving location, time, and price into the distribution dApp in the proposed B2B distribution platform, the owner is able to identify regular or irregular orders according to the region or time, making it possible to select attractive transportation orders by taking into consideration an optimum driving route.

In other words, our proposed model will play the same role as Uber in relation to intra-platform transactions, while also increasing profitability of freight transportation by allowing periodic logistics orders and multiple, one-time deliveries by taking into consideration the driving route and cargo volume. Moreover, the user can reduce transportation commission costs through free competition among truck owners. On the other hand, all product transportation records are recorded in the blockchain together with the relevant transaction ledger, which provides transparent information for delivery tracking and in case of any transportation accidents. In addition, the platform will be able to extend beyond simple, short-haul transportation to even long-distance transportation between producers and distributors, and ultimately to the area of imports/exports and commerce.

5. Coin Economy

5.1. Overview

There are two types of cryptocurrencies used within the platform. The first coin is used as a medium of exchange for food transactions, and the other is mainly used as a medium of exchange for transactions for various IT services provided on the platform.

For both cryptocurrencies, there are many differences in terms of the acquisition method, pricing, characteristics, and use. However, they are the same in the sense that they are designed to maintain and develop the ecosystem of the proposed platform and to provide compensation and benefits for platform participants utilizing the platform. Further information regarding the first and second coins are set forth in the following sections.

5.2. The first cryptocurrency

5.2.1. Overview and Characteristics

The first coin is a cryptocurrency designed as a medium of exchange for the purpose of providing convenience in executing food transactions among participants of the proposed platform. In cases of price instability of the means of exchange within a platform, participants who participate in e-commerce through the platform bear the risk of price fluctuations, and therefore, the first coin needs to ensure high short-term price stability.

To accomplish this, the first coin uses a reserve anchoring algorithm which is a method to guarantee the first coin based on its reserve fund deposited in major financial institutions. Similar with major central banks that maintain reserves composed of foreign currencies or gold in order to secure price stability, the first coin maintains a reserve in the form of currencies comprising of the Standard Basket System of the International Monetary Fund (IFM) Special Drawing Rights (SDR). As its reserve is composed of various currencies, the first coin can execute its own independent monetary policies, reducing the risk that monetary policies of specific countries affect the price of the first coin.

The first coin has the key advantages of a cryptocurrency, as well as the following additional advantages. First, the first coin has high price stability. In the early stages, the first coin's reserve requirement ratio is set at a maximum of 100%, and the minimum level of the reserve requirement ratio is set at a level that is at least 10% higher than the level set by existing cryptocurrency exchanges, even at times when the first coin's market capitalization continues to grow, effectively maintaining a high level of market stability. The short-term price stability achieved through this pricing policy protects the platform participants from the risk of a sudden price increase or decline in the price of the first coin.

Second, the first coin can be instantaneously acquired and disposed. The first coin contracts process issuance or clearing orders immediately based on its pricing policy, so there is no need for the existence of counterparty transactions. Accordingly, participants can acquire or liquidate the first coin through smart contracts without going through an exchange, and it is possible to execute small-size transactions with the first coin.

Third, the price of the first coin is determined in a transparent and independent manner. The price of the first coin is predefined in its contract, and as a result, the price of the first coin is constantly adjusted and

announced publicly. This pricing mechanism not only reduces the operating costs associated with the first coin, but through an automated and transparent governance structure also reduces the risk of governance bias and governance costs.

5.2.2. Acquisition Method

Participants can purchase the first coin by paying in Ethereum. Specifically, when a participant who desires to acquire the first coin transfers Ethereum to the contract address, the predefined contract generates a first coin token corresponding to the value of the transferred Ethereum according to a predetermined exchange rate and delivers the first coin to such participant. Most of the Ethereum sent to the contract address is converted into the major currency types equivalent to the Standard Basket System of the IMF SDR and deposited into the first coin main reserve, while the rest of the Ethereum is used in its present state as liquidity funds.

5.2.3. Use and benefit

Participants will pay the first coin, not cash, to the seller in order to purchase food supplies through the B2B distribution platform. Accordingly, parties who sell food supplies can use the first coin received from the buyer to purchase other food supplies. In this way, the first coin is used as a medium of exchange among transaction counterparties in the food transaction value chain within the platform, thereby creating a virtuous cycle within the ecosystem of the proposed model.

Participants can also convert the first coin into Ethereum, which is easy to withdraw as cash through smart contracts, rather than using it for food transactions. When a participant wishing to dispose (liquidate) a first coin sends it to the contract address, the contract will withdraw the corresponding value of the first coin transmitted at the predefined exchange rate in Ethereum from the liquidity fund or the first coin Main Reserve and send it to the participant. The first coin transferred to the contract is retired after liquidation.

5.2.4. Determination of price and transaction conditions

The primary goal of pricing policy for the first coin is to secure its price stability and to support the growth of the first coin economy. In order to balance these two goals that may be considered contradictory, the first coin economy is divided into three stages with differentiated goals for each stage, while the reserve requirement ratio and the first coin's price function are guaranteed to be continuous throughout all stages and is designed in the form of a piecewise function.

1. At the early stages of the first coin economy, the first coin economy's size is small with high volatility in the intrinsic value of the first coin. During this period, the reserve requirement ratio remains at 100% to ensure the first coin price stability, and the price remains constant in order to reduce the risk of the first coin economy's shrinking. The fixed reserve requirement rate of 100% is maintained until the first coin's market volume reaches 300 million coins.
2. If the intrinsic value of the first coin grows steadily as the market volume of the first coin increases, the first coin price policy will support the growth of the first coin economy as a top priority, and the reserve requirement ratio will gradually decrease accordingly. Until the first coin's market volume reaches 3 trillion, the reserve requirement ratio will decrease in accordance with a predefined plan until it reaches the minimum level of 10%. The fixed reserve requirement ratio will remain within the range of 10% to 100%, and the proportion of the impact of the first coin's intrinsic value on its price will gradually increase.
3. When the first coin's market volume exceeds 3 trillion in total, the first coin will have a high intrinsic value, and as a result, it will no longer be necessary to secure stability based on the value of major currencies. After this stage, the first coin will be able to serve its role as an independent currency with its reserve requirement ratio remaining fixed at the minimum level of 10%, and the first coin's price will be correlated with its intrinsic value.

The relationship between the price of the first coin and its reserve requirement ratio is determined by the following two equations.

$$r(N) = \frac{R(N)}{N \cdot P(N)} \quad (1)$$

$$R(N) = \int_0^N P(n)dn \qquad (2)$$

Equation (1) defines the reserve requirement ratio, and equation (2) is the sum of the deposits until the issuance of *N* number of Tallies, which represents the balance of the reserves after the issuance of *N* number of Tallies. Equations (1) and (2) can be reorganized as

$$P(N) = \frac{1}{N \cdot r(N)} \int_0^N P(n)dn \qquad (3)$$

and this equation calculates the price at the point when *N* number of Tallies are issued[1]. Based on this pricing model, the price of the first coin is expected to be stable or increase based on the currency volume.

The reserve requirement ratio is defined as a sub-interval function in the form of a simple linear function within one interval between the key monetary milestones of a pre-specified first coin economy. Based on this definition, by using equation (3), the required value to issue 1 first coin Token can be expressed in the following equation.

$$E(N) = R(N) \cdot \left(\sqrt[r(N)]{1 + \frac{1}{N}} - 1 \right) \qquad (4)$$

Based on the aforementioned the first coin pricing policy, the price of the first coin can be continuously adjusted through the issuance of new the first coin or settlement of existing the first coin, resulting in a change in reserve deposits or the first coin currency volume. The price of the first coin token issuance and clearing orders can be expressed as the sum of several order prices divided by one unit of the first coin. The continuous adjustment of the first coin price allows issuance and clearing orders to search for new price equilibrium points until they reach an equilibrium price regardless of the number of transactions. The nature of this pricing policy is designed to prevent attempts by forces hoping to benefit through the artificial price manipulation of the first coin.

Through the first coin's pricing model, the price of the first coin can be estimated. The important point in the first coin's price prediction is that the price of the first coin is in the form of convex function that monotonically increases with respect to the currency volume. When the first coin's market volume reaches a certain level, the price of the first coin also increases accordingly.

5.3. The second type of coin

5.3.1. Overview and characteristics

If the first coin is used as a medium of exchange for food supply transactions, which is the main function of the platform, the second coin will function as a medium of exchange for various services, aside from food supplies, provided by the participants through the platform, such as dApps. As the first coin is linked to spot transactions, it is necessary to keep its price stable, whereas the price of the second coin is determined more freely and thus relatively volatile.

5.3.2. Acquisition method

Participants can participate in the coin sale, such as an ICO or IEO, which will be completed at the early stages of the project and purchase second coins with Ethereum. 40% of the second coins issued will be sold to participants through a coin sale, and no additional second coins will be issued thereafter.

On the other hand, participants who wish to purchase second coins after the coin sale can purchase second coins from other participants through the secondary market, such as cryptocurrency exchanges.

In addition, participants who make positive contributions to the platform may receive second coins as compensation. The second coins are expected to be the driving force for user compensation, data collection, customer input, growth engine, and value expansion, especially during the first three years of operations to

[1] The first coin pricing policy was designed based on the *Bancor formula.*

facilitate rapid growth in the early stages. On the other hand, second coins paid as compensation may require a specific vesting period before the coin can be liquidated or exchanged into other forms of currencies, and the use of the second coin may be limited to payments for services within the platform.

5.3.3. Use and benefit

Participants can pay or deposit second coins and use the following additional services provided within the proposed B2B distribution platform.

1. Additional value-add services for buyers: Just as how Amazon provides benefits to its customers through Prime Membership, including free delivery and discounts, e-commerce companies are actively utilizing fee-based services as a platform growth strategy to attract its attractive customers. The premium service also promotes continuous use of our services by providing convenient services to its customers, including free delivery, free quotations, and free samples. In addition, it provides high-quality products to buyers at relatively low prices with futures trading and group deals through crowdfunding, which is provided as an additional fee-based service, and improves the distribution structure through information-sharing to create a production and distribution economy centering around trading counterparties.
2. Additional value-add services for sellers: Recently, e-commerce businesses have been creating effective targeting strategies based on vast customer data, generating massive advertising revenue. Amazon's ad sales recorded USD 1.65 billion in 2017, exceeding the ad sales by Twitter at USD 1.21 billion and Snapchat at USD 0.64 billion. Our model proposes a similar premium service that also develops advertising and marketing services through transaction record data analytics and provides it for a fee to help sellers make efficient decisions and improve profitability.
3. Operating rights: Some large merchants and dApp operators are required to deposit second coins in the second coin Main Reserve as a prerequisite for operations and participation within the platform. This obligatory deposit incentivizes sellers and dApp operators to engage in an economic community based on trust, and serves as a transaction guarantee for sellers and dApp operators, preventing intentional unfair transactions. For participants requesting a deposit withdrawal, the deposited second coins can only be withdrawn after a 13-week vesting period.

In addition, second coins can be exchanged for the first coin through smart contracts (however, the first coin cannot be exchanged for second coins). Participants who desire to liquidate their second coins through main contracts send the second coins to the contract and receive the corresponding the first coin from the first coin Main Reserve. The second coins sent to the platform is converted into Ethereum through a clearing process through an external cryptocurrency exchange and then transferred to the contract, thereby issuing the first coin coins of corresponding value to the Ethereum. In this case, a portion of the Ethereum transferred after the exchange to the platform will be used as a liquidity buffer, and the remainder will be used as reserve funds for the first coin, while the newly issued the first coin will be deposited in the first coin Main Reserve as a reserve for the second coin holders. This exchange of second coins to the first coin has a favorable effect on the second coin holders, which is similar to a buy-back program, in that value of the second coin is linked to that of the first coin.

5.3.4. Determination of price and transaction conditions

Second coins can be exchanged for the first coin at a pre-defined exchange rate as a function of economic scale. The value of the second coin is lower than that of the first coin at the stage where the economy of the proposed B2B food distribution platform is small and carrying high risk, but as its economy grows, the value of the second coin is designed to increase and surpass the value of the first coin.

As mentioned previously, the second coin can be exchanged for the first coin. In order to enable such exchange to be possible, whenever the first coin currency volume reaches a major milestone, a pre-defined number of the first coin is issued, and the issued the first coin is deposited into the first coin Main Reserve in case of the first coin exchange requests for second coins. At this time, the exchange rate between the first coin token and the second coin is calculated by dividing the remaining quantity of the first coin tokens issued for the second coin holders by the total volume of the second coin.

However, the price of the first coin token is determined as a function of the first coin currency volume and reserve requirement ratio. In this case, it may be a concern that the new issuance of the first coin for the second coin holders could undermine the benefits for existing the first coin holders. However, the new the first coin tokens provided for the second coin holders at particular key currency volume milestones are designed to ensure that existing the first coin token holders are not disadvantaged at any point in time by applying the regulatory factor $F^2 < 1$ to the reserve requirement ratio after key currency volume milestones in the previous phase.

On the other hand, the amount of the first coin tokens issued for the second coin holders follows the form of an increasing function that increases with the increase in the first coin's currency volume. Note that the value of the second coin is expected to stabilize and rise steadily with the growth of the first coin's market size.

5.4. Compensation mechanism

5.4.1. Compensation standards and conditions

Considering that the contribution of the participants determines the success of the proposed platform, our model adheres to the principle of returning most of the value created by the economy to its participants who are operating within the platform or have made valuable contributions. This is a principle that is generally adopted in other cryptocurrency economies that provide fair compensation to its participants using blockchain technology, incentivizing participants to participate in its early stages and promoting growth.

The proposed platform not only connects the data generated through participants in the platform to participants in need, returning the value created back to the participants contributing to the data generation, but through blockchain also returns the value created from the provision of data generated or provided by buyers and sellers to external corporations back to the data provider or generator in a transparent manner. The following is a summary of the types of data-related contributions that are subject to compensation.

1. Provision of transaction information: A common issue that cryptographic economies encounter is to fairly assess the contributions of participants and prevent counterfeiting of information to obtain unfair compensation. The proposed B2B distribution platform has a structural advantage in that participants can assess participant contributions based on the profits generated through relevant transactions, and as a result, the platform reviews participating transaction records in order to assess meaningful contribution levels of the participants. The platform compensates sellers and buyers who agree to disclose information based on the completed transaction volume.
2. Review of transaction counterparties: Buyer and seller feedback on completed transactions is an important basis for other participants to make judgments about future counterparties. Therefore, feedback from transaction participants is considered to be an important contribution and is subject to compensation. All feedback is assessed with equal value, and participants are compensated for the amount of feedback given based on a weighted value of the completed transaction for which the feedback is given.
3. Provision of personal information: A major advantage of the platform is that it uses blockchain technology to collect and manage data, including key personal information and transaction information. This personal information is created at the customer's discretion and is used first in our platform. All information providers can set the level of disclosure to meet their individual needs, and participants who decide to disclose their information will be compensated with the value added by the disclosure.

In addition to providing data to the platform and agreeing to the use of such information, participants can contribute to the growth of the economy and obtain rewards in the following ways:

1. Platform application: Securing new customers is a prerequisite to promote sustainable growth and increasing efficiency. To do so, new merchants and dApp developers on the platform can be rewarded for completing transactions within 30 days of registration. The size of the compensation is determined by the size of the transactions in which the participants participate.

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[2] $F = \frac{N}{N+n}$. N and n indicate the amount of The first coin to be issued from the current market volume to the next major currency volume milestone.

2. New customer recommendation: A participant who recommends a new participant will be compensated once the recommended participant completes his or her first transaction. The level of compensation is determined based on a weighted value of the total value of transactions that the new participant has completed within 30 days of registration.
3. The first coin reserve fund deposit: Securing and maintaining sufficient the first coin reserves is a key element for the continued growth of the project, and thus the first coin contract encourages participants to deposit reserves. In order to obtain compensation through reserve deposits, participants must pledge such deposit as a long-term investment and observe a vesting period for 13 weeks during which withdrawals are restricted. After this period has passed, participants can freely withdraw their deposits.
4. Lastly, the first priority of the project is the growth of the B2B food distribution platform. Therefore, 20% of the market capitalization of the second coin will be deposited in the reserve wallet and will be used to provide compensation for all participants on the platform for the first three years after its launch. Through such compensation policies, the platform will be able to secure stability and accelerate growth by attracting users during periods of high volatility.

5.5. Inflow and processing method for funds generated from the platform

For various reasons, various funds enter the platform and the causes for such funding inflow and the use of such funds are as follows.

1. Interest from deposit: The fiat funds deposited for the purpose of The first coin payment reserve funds are stored in major financial institutions. This process may generate interest income, and the total amount of such income will be deposited in the first coin Main Reserve for The first coin owners.
2. Transaction fee for exchanging The first coin to Ethereum: If the exchange service between The first coin and Ethereum be provided free of charge, there is a risk that certain individuals or groups may attempt to profit by repeatedly exchanging The first coin in large volumes to impact the first coin price.
   In order to prevent such price manipulation activities and protect the first coin currency, although Ethereum-to-The first coin exchange services are provided free of charge, the first coin-to-Ethereum exchange services will incur an exchange fee of a maximum 3% of the requested amount. This exchange fee income will be deposited into the Main Reserve of the first coin for the benefit of the first coin owners.
3. Transaction cost: The platform creates value through the active participation of its participants. From this perspective, it is unsuitable to impose transaction fees on participants contributing to the growth of the platform by executing transactions, and the continuous costs incurred through The first coin transactions will ultimately reduce incentives for participants to use the platform and have a negative impact on the ecosystem.
   For such reasons, our model provides food transaction services among participants through the platform free of charge and will not impose any additional costs. The provision of free services allows for the proposed B2B food distribution platform to have a competitive advantage against other blockchain projects with business models that charge transaction commission fees from participants.

6. Conclusion

We proposed a B2B food distribution platform that brings innovation into the domestic B2B food distribution market and systematically manages and utilizes the massive data (country of origin, producer, transaction, distributor, final consumer) generated within the food distribution process. Based on a transformation of an established food distribution management platform using blockchain technology, our proposed model introduces a method to share necessary information transparently, by trading and utilizing the food transaction data within the market, and resolves the many existing issues the current domestic B2B food distribution markets have.

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