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Internet-Based Vehicle-Cargo Matching Platform Enterprises in China

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Abstract: This paper examines vehicle-cargo matching platform enterprises in China, which play the role of non-truck operating common carriers that are the freight operator by entrusting transportation duties to the actual carrier. We summarize several kinds of operation modes for vehicle-cargo matching: simple vehicle-cargo matching; whole-vehicle system with single loading and multiple unloading; virtual fleet; and integration of whole-vehicle service and carpooling. We selected representative enterprises and analyzed such features as their operation, advantages and disadvantages, profit model, and applications. We compare and analyze those systems.

Key words: vehicle-cargo matching; operation mode; non-truck operating common carrier; Internet

1 Introduction

According to *Statistics of the Transportation Industry in 2016*, published by the Ministry of Transport of the People's Republic of China, 334.13 million tons of cargo in China in 2016 were transported by road. That amounted to 77.5% of the total volume of various modes of transport. It is evident that road transport plays a leading role among all transport modes. However, the no-load rate and empty return rate for road transport are high in China. That is a result of the information asymmetry between the sources of goods and vehicles and the large number of trucks owned by individual enterprises. It has been determined that the no-load rate for Chinese road transport is up to 40%: in Europe, it is on average 20%; in the United States and Japan, it is about 10%[1]. Ineffective transportation results in a great waste of public transport resources,

[1] Data come from the Web site of China highways (http://www.chinahighway.com/) and the Ministry of Transport of the People's Republic of China (http://www.mofcom.gov.cn/)

leading to low logistics efficiency and increasing logistics costs. It also aggravates pressure on public transport and on the environment.

In recent years, non-truck operating common carriers (NTOCCs) and other new operation modes have emerged in China's freight and logistics market. NTOCCs are the freight operator by entrusting transportation duties to the actual carrier. NTOCCs fulfill a carriage contract with the shipper and assume the carrier's responsibilities and obligations. The aim with NTOCCs is to alleviate waste in vehicle and cargo resources as well as to establish an information integration platform for vehicles and cargos. NTOCCs have become an important means of solving logistics problems, such as the serious information asymmetry between vehicles and cargo in China's freight and logistics market. Bearing the identity of carrier, In recent years, a large number of vehicle-cargo matching platform enterprises have emerged in China's freight and logistics market. These enterprises do not own vehicles; they rely on mobile Internet platforms to engage in the transport business and play the role of NTOCCs. Using information and communication technology, vehicle-cargo matching platform enterprises employ the power of the Internet to tackle logistics. In China's developing market, vehicle-cargo matching platform enterprises have gradually expanded their operations. In September 2016, the Ministry of Transport of the People's Republic of China issued a written approval, "Opinions about Recommending a Pilot Reform to Speed Up Logistics Innovation and Development of Non-truck Operating Common Carriers." The ministry began conducting pilot studies about NTOCC road freight throughout the country, which promoted the rapid development of vehicle-cargo matching platform enterprises.

2 Literature review

2.1 Research on logistics information platform based on Internet

The Internet-based logistics information platform of NTOCCs has attracted the attention of scholars in China and overseas. Wang and Sun[1] conducted research on the theory definition of logistics information platforms based on big data and establishing a typical big-data logistics platform. The authors identified some problems in the construction of a logistics information platform based on big data. For example, the mechanism of enterprise cooperation is imperfect; the extraction capacity of big data is insufficient; security protection of the platform has vulnerabilities. Wang and Sun

offered solutions to those problems. Based on the service model of a logistics information platform, Xing et al.[2] proposed a logistics information service model based on cloud ecology; it uses cloud computing theory, business ecosystem theory, and two-sided market theory. The model has had a guiding significance for the development of the logistics industry in the era of the cloud economy. Huang[3] analyzed the business model of a logistics information platform based on mobile Internet technology. To increase customer stickiness, Huang believed that using big data, the Internet of things, and artificial intelligence should be the development direction of enterprises involved with logistics information platforms. Wang[4] compared a logistics information platform based on location services with a conventional logistics information platform; he concluded that the former had obvious advantages in terms of response time, monitoring intensity, and service orientation. Xing[5] analyzed the construction, function, and application of a logistics cloud platform. The author suggested a cloud distribution mode according to the relationship between cloud computing and logistics distribution. Based on an analysis of the connotation and mode of cloud distribution, Xing[6] identified vehicle scheduling problems related to multiple distribution centers with that cloud distribution mode. Abrahamsson et al. defined and described a logistics information platform; they believed it to be a very important part of a logistics information system as well as the management and control center of logistics information. Good operation of a logistics information platform can effectively improve the flexibility of enterprises.

On the whole, scholars both in China and overseas have affirmed the future of logistics information platforms. With respect to NTOCCs, the promotion of an intelligent logistics information platform would have a positive significance for the development of enterprises and urban logistics.

2.2 Research on vehicle-cargo matching problems

As one of the core problems of NTOCCs, the vehicle-cargo matching problem is a common starting point for scholars in China and overseas in studies of NTOCCs. In China, scholars place the greatest emphasis on the construction of vehicle-cargo matching systems. Sun[7] developed the intelligent matching of supply and demand to achieve a fourth-party logistics platform combined with regional factors. Sun constructed a three-level index system of logistics supply-and-demand matching. The system included a comprehensive supplier capability system, a coefficient for regional

services, and past cooperation indicators; thereby, an intelligent matching model of logistics supply and demand was established. Yang[8] believed that a trading Web site for vehicle-cargo matching should make full use of information technology and mobile communication tools. Such a site could to some degree solve problems related to information asymmetry between vehicle and cargo and reduce no-load transport, waiting, unlimited road use, and other uneconomical transportation issues. Shi[9] adopted the idea of “division before distribution” when she studied the vehicle routing problem using a logistics cloud platform. Shi determined that the location of the owner and the demand side should be regionally divided and that the dispatching should be conducted in an appropriate area. Li[10] investigated the development of highway freight transportation and logistics information service platforms. Li studied the vehicle-cargo matching problems of a stowage logistics information service platform in the development of a highway transport and logistics information service platform. Li established a post-transaction reputation evaluation model as well as a multi-objective matching and ordering model for the supply and demand of goods and vehicles. Outside China, the matching process has received the greatest interest. Korkmaz et al.[11] determined that the bilateral matching model attempts to match the employee and employer. The model makes each side accept and be satisfied with the matching result: if such a match occurs, it is stable. Lau and Goh[12] designed a framework based on intelligent matching agents to support 4PL services online and implemented the system using J2EE(Java 2 Platform, Enterprise Edition) technology.

Researchers in China and overseas have focused on the matching mechanism and process of vehicle-cargo matching. However, there has been a lack of research into the operation mode of vehicle-cargo matching platforms. At present, numerous vehicle-cargo matching platform enterprises are operating in China. They each have different operation modes, and they are operating in their own mode. Theoretical research has lagged behind practical development, and further studies are needed to guide such development.

3 Analysis of typical vehicle-cargo matching platform enterprises

3.1 Analysis of No. 1 Freight Car

3.1.1 Brief introduction of No. 1 Freight Car

Founded in October 2014, No. 1 Freight Car is a platform that provides intelligent

logistics services for drivers and shippers. Its business covers Beijing, Shanghai, Guangzhou, Shenzhen, Tianjin, Hangzhou, and 17 other cities. There are two types of apps with No. 1 Freight Car: one for drivers and one for shippers. The original version (1.0) served as a link between the logistics platform and merchants, and it focused on promoting and opening the market. At that stage, it operated mainly for drivers and small and medium-size private businesses, and it was in need of improvement[2].

On May 20, 2015, version 2.0 of No. 1 Freight Car was released. Compared with version 1.0, it was more intelligent and humanized. The "Nonstop" and "Intelligent" Distribution services, which appeared in version 1.0, effectively met the demands of logistics market segmentation. The main target of the "Nonstop" business group and the "Intelligent" is a company that handles heavy cargo and customers with fixed delivery requirements within a certain period of time. The function of "Return Truck" in version 2.0 effectively reduced the empty return rate after delivering goods. The main target of the "Return Truck" is the drivers who needs to choose whether or not to receive orders through intelligent matching before returning after making a delivery. The service function of Intelligent Distribution in version 2.0, which was directed at large enterprises with logistics demands, provided simultaneous delivery of multi-point goods within a city[3].

3.1.2 Operation analysis of No. 1 Freight Car

With version 2.0, No. 1 Freight Car no longer rigidly focuses on distance; it provides different standardized product services with different characteristics. It includes three types of service: nonstop business group; intelligent distribution business group; and logistics business group. The main target of the nonstop business group is a company that handles heavy cargo, such as building materials and home decorations. Using point-to-point methods, the nonstop business group is supported by big data and offers a nonstop service. No. 1 Freight Car provides an accurate bidirectional cross-platform for truck drivers and cargo owners and can match customer requirements intelligently. No. 1 Freight Car achieves the free matching of drivers and owners, providing point-to-point delivery within a city. The intelligent distribution business group comprises customers with fixed delivery requirements within a certain period of time. The intelligent distribution with No. 1 Freight Car provides the simultaneous

[2] Data adapted from official Web site of No. 1 Freight Car: http://yihaohuoche.com/.
[3] Data adapted from Sina News: http://news.sina.com.cn/o/2015-05-22/113431864144.shtml.

delivery of multi-point goods within a city. For the owner, the system automatically finds the optimal vehicle, optimizes the allocation of transport resources for enterprises, and selects the best freight route for delivery. The logistics business group mainly involves customers wanting network LTL(Less-than-Truck-Load), express, and collect on delivery (COD) services [4]. No. 1 Freight Car offers the function of Return Truck largely to reduce the empty return rate after delivering goods. With this function, drivers can choose whether or not to receive orders through intelligent matching before returning after making a delivery. The cargo owner knows in advance the driver's return destination, and so the owner is able to find the driver who can offer timely delivery. The vehicle-cargo matching system of No. 1 Freight Car is depicted in Figure 1.

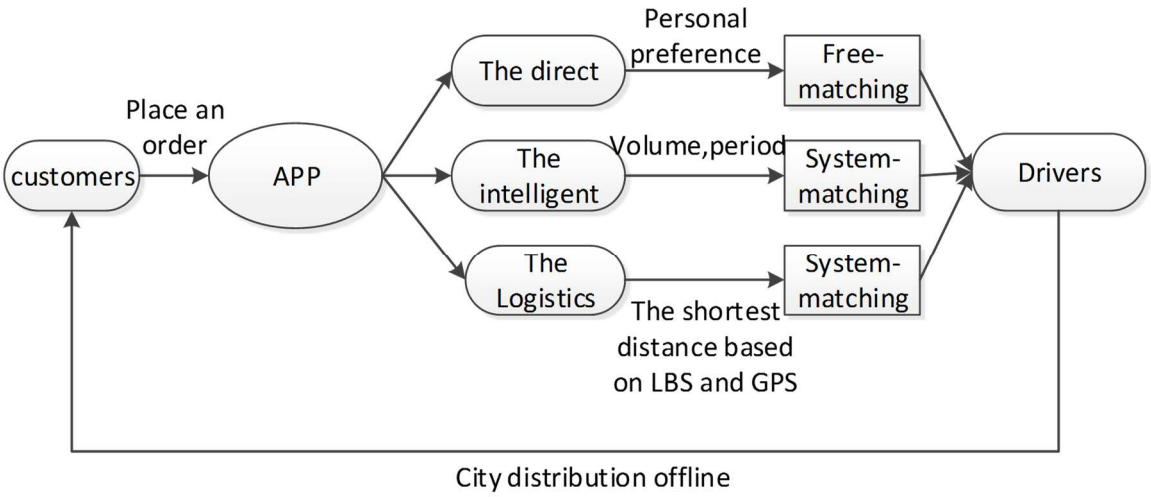

Fig. 1. Vehicle-cargo matching system of No. 1 Freight Car

3.1.3 Advantages and disadvantages of No. 1 Freight Car

3.1.3.1 Advantages

3.1.3.1.1 Low cost. As a vehicle-cargo matching platform, there is no need for No. 1 Freight Car to have a self-operated fleet for intra-city transport. However, it can provide related resources for vehicle matching, and it can save costs for vehicle purchase and management.

3.1.3.1.2 High efficiency. Based on location-based service (LBS), global position system (GPS) and other positioning technology, No. 1 Freight Car can locate nearby vehicles quickly. It can provide an instant ride-hailing service and efficient delivery service in the door to door transport.

3.1.3.1.3 Low empty return rate. The Return Carpooling service of No. 1 Freight Car allows drivers to report their route for the return journey. Then, based on LBS and

GPS, the system automatically finds a nearby shipper who has a delivery demand. Finally, the relevant information is sent to the driver. In this way, drivers can effectively reduce their empty return rate and increase profits; shippers are allowed to carpool and obtain a greater freight discount.

3.1.3.2 Disadvantages

3.1.3.2.1 Essential differences between good distribution and taking a taxi. The former is a more complex process, has more diverse requirements, and is hard to standardize. If No. 1 Freight Car simply imitated the system of taxi-hailing company Didi Chuxing, it would not be able to meet the distribution needs for different goods.

3.1.3.2.2 Not closed payment. The amount of freight involved in logistics distribution is considerable. Thus, drivers cannot produce invoices for each item, though they need to sign receipts. In addition, the accounting period and other problems mean that with No. 1 Freight Car, there is a time difference in settlement between drivers and shippers. Accordingly, a certain amount of risk is involved.

3.1.3.2.3 Unclear profits. At present, the main income for No. 1 Freight Car platform is still deposits and commission. Other profit characteristics need further clarification.

3.1.4 Analysis of profit system for No. 1 Freight Car

As its source of income, No. 1 Freight Car currently receives a deposit from drivers who require guaranteed orders. No. 1 Freight Car integrates idle capacity through its vehicle-cargo platform, and is expanding urban transport capacity. In addition, it constantly improves its self-management system through recruitment, training, assessment, and other mechanisms. In the future, it aims to make profits by collecting training fees, commissions, and transport differentials.

3.1.5 Application conditions for No. 1 Freight Car

A simple vehicle-cargo matching system does not subdivide the distribution of goods, and it does not take into account differences in the nature of goods. Thus, this type of system requires goods of a similar nature, and it does not allow special requirements for distribution.

3.1.6 Classification of No.1 Freight Car

Based on LBS, No. 1 Freight Car connects truck drivers and shippers. Users place delivery requests on the platform, and truck drivers take orders online. This creates an urban freight platform with high consumer demand and frequency[13]. No. 1 Freight Car is an urban distribution platform, and it completely follows the system of taxi-hailing company Didi Chuxing[14]. We regard No. 1 Freight Car as a simple vehicle-cargo matching system. In China, other enterprises that use a similar vehicle-cargo matching system to No. 1 Freight Car include 58 Suyun and Huo Lala.

3.2 Analysis of Blue Rhinoceros

3.2.1 Brief introduction of Blue Rhinoceros

Founded in November 2013, Blue Rhinoceros is an information service platform for dealers, logistics parks, customers of business enterprises, wholesale market merchants, and private individuals. It can provide trucks for both urban services and for urban COD. Blue Rhinoceros constantly sends information about traffic conditions to the driver and cargo owner; it integrates idle vehicles and driver resources to achieve urban distribution. Vehicle resources used in the urban distribution platform of Blue Rhinoceros are vans, Jinbei Cars, and similar models. The platform is intended to solve users' needs for such tasks as delivering furniture and other merchandise. Blue Rhinoceros conducts operations in Beijing, Shanghai, Guangzhou, Shenzhen, Hangzhou, Nanjing, Chengdu, and other first- and second-tier cities.

The main purpose of Blue Rhinoceros is to integrate customer resources through its platform; it also executes some market orders. In the freight market, there are different prices and services. However, Blue Rhinoceros uses a standardized procedure for its cars, charges, orders, and other matters. In that way, it has laid the foundation for good future market development. The structure of the platform is such that drivers have a great sense of responsibility, which helps to enhance the platform's social value and status[4].

[4] Data adapted from the Web site of ebrun: http://www.ebrun.com/20141216/118340.shtml.

3.2.2 Operation analysis of Blue Rhinoceros

For vehicle and cargo matching with Blue Rhinoceros, shippers issue delivery details online through an app. That includes such information as the starting point, end point, and basic attributes of the goods (including such information as type and size). The system determines the shortest, optimal route for shippers. After online payment, the system sends the delivery order to the appropriate driver: the driver closest to the delivery point gets priority, but that driver cannot then immediately receive another order.

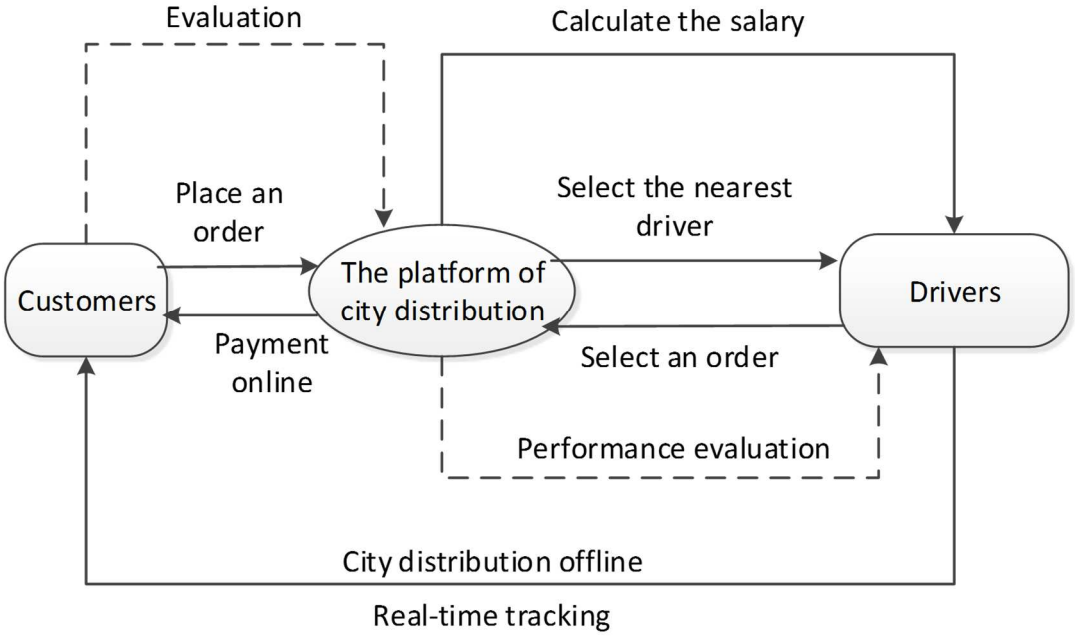

Fig. 2. Vehicle-cargo matching system of Blue Rhinoceros

3.2.3 Advantages and disadvantages of Blue Rhinoceros

3.2.3.1 Advantages

3.2.3.1.1 Standardized distribution. In contrast to simple vehicle-cargo matching, this system takes into account different attributes of goods, which affects the standardization of distribution. This is a different system from taxi hailing.

3.2.3.1.2 Guaranteed consumption pattern. This model has a closed-loop consumption structure, which further enhances standardization of service quality.

3.2.3.1.3 Optimized system. The single-loading and multiple-unloading system (equivalent to a simple carpooling system) meets basic infrastructural needs and supports the aggregation and distribution of information and goods.

3.2.3.2 Disadvantages

Urban logistics distribution involves dispersed goods and considerable distribution limitations. Thus, products where the minimum trading unit is a whole vehicle require that customers have the ability to collect their goods. For the driver, the lack of ability to receive secondary orders does not address the problems of urban distribution, such as difficulty in collecting goods, high costs, and long working hours.

3.2.4 Analysis of profits for Blue Rhinoceros

3.2.4.1 Profits for drivers

Blue Rhinoceros does not offer payments fixed payments to drivers. Blue Rhinoceros simply integrates idle capacity within a workforce; thus, many drivers working under this platform have no fixed income and there are no basic wage guarantees. However, joining Blue Rhinoceros allows drivers to obtain additional extra income when they are free: that is an incentive for the drivers. Blue Rhinoceros is also making efforts to make its part-time drivers work full time; that will provide additional job security for those drivers.

3.2.4.2 Profits of Blue Rhinoceros

Blue Rhinoceros takes a 10% commission from each order of its drivers; however, that is not its main source of profit. Blue Rhinoceros is currently accumulating customers: it is aiming in the future to make profits through adding value and other ways. With regard to promotion, Blue Rhinoceros largely adopts the recursion method. That method is more common with freight app-based enterprises, which assign promotion personnel for work in the market.

3.2.5 Application conditions for Blue Rhinoceros

The system works well when there is a sufficient supply of goods. However, in the business-to-customer mode, there is a small possibility of the customer accumulating goods until they need vehicle distribution. Business class users tend to employ their own fixed drivers and vehicles. Thus, Blue Rhinoceros is often used only when there is a very urgent need and no other suitable vehicles are available. Blue Rhinoceros allows single loading and multiple unloading, and the number of customer class users is

relatively small; thus, Blue Rhinoceros tends to operate with urban distribution for business-to-customer demands.

3.2.6 Classification of Blue Rhinoceros

Drivers for Blue Rhinoceros can choose only a single, one-to-one service during a certain period of time. However, if needs arise, the drivers can offer multiple delivery services and undertake one-to-many distribution when completing a single order. For customers, this service is clearly attractive; for drivers, it increases their work opportunities. We regard Blue Rhinoceros as a single-loading and multiple-unloading system.

With a whole-vehicle service with single loading and multiple unloading, customers can choose the type of vehicle according to the characteristics of goods, (including volume, weight, chemical characteristics, and other factors); however, the basic unit of each transaction is the whole vehicle. Through the Internet, GPS, geographic information system, and other technologies, the Blue Rhinoceros model is essentially real-time vehicle-cargo matching with the support of a mobile terminal.

3.3 Analysis of Cloud Bird Distribution

3.3.1 Brief introduction of Cloud Bird Distribution

Founded in November 2014, Cloud Bird Distribution is an Internet platform dedicated to urban distribution. Through its use of information technology, it is the leading supply chain distribution service provider in China. Cloud Bird Distribution integrates mass social capacity resources to achieve accurate, efficient matching of transport capacity and enterprise distribution requirements; it provides urban and regional distribution services to all kinds of customers. Cloud Bird Distribution redefined the service standard system for urban distribution; it established industrial-level field management and provides provide good service experience. It serves Beijing, Tianjin, Qingdao, Nanjing, and other 18 cities in China, and it has more than 10,000 enterprise customers[5].

[5] Data adapted from the official Web site of Cloud Bird Distribution: http://www.yunniao.cn/public/about.

3.3.2 Operation analysis of Cloud Bird Distribution

The customers of Cloud Bird Distribution are mostly enterprise customers, and it has stable distribution demand. Customers place their vehicle demand details on the platform, and Cloud Bird Distribution quotes a price for the distribution task according to that information. Customers then select vehicles based on their particular needs. In general, vehicle information and the quoted price are decisive factors. After vehicle-cargo matching has been achieved, Cloud Bird Distribution enters the stage of offline pickup and delivery, and the whole transaction is then completed. The operation system with Cloud Bird Distribution is depicted in Figure 3.

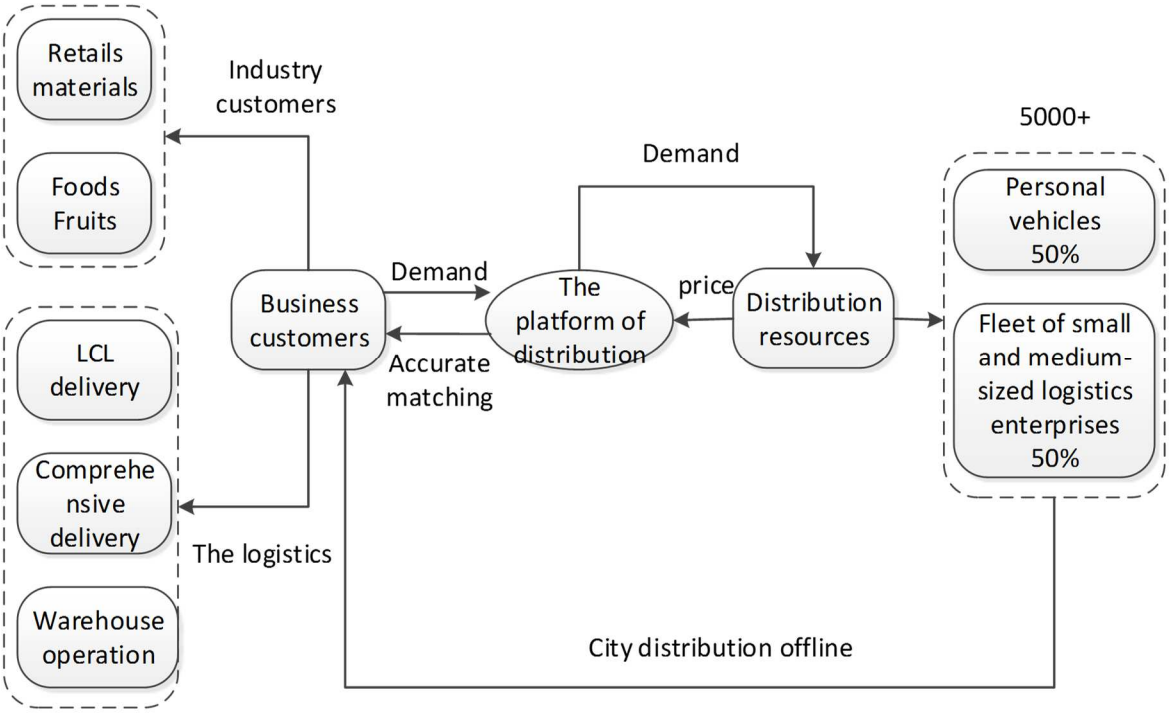

Fig. 3. Vehicle-cargo matching system of Cloud Bird Distribution

3.3.3 Advantages and disadvantages of Cloud Bird Distribution

3.3.3.1 Advantages

3.3.3.1.1Information transparency. Cloud Bird Distribution has changed the information asymmetry and opacity in the logistics industry. It allows customers to increase their transport capacity.

3.3.3.1.2Freight reduction. Cloud Bird Distribution adopts a bidding system, and the lowest bid often wins. That helps customers reduce their costs for logistics distribution.

3.3.3.2 Disadvantages

3.3.3.2.1Unclear profits. With a bidding system, a low-price strategy is often adopted. However, distribution services have rigid costs, and drivers cannot lose money in their business over the long term. Thus, to compensate, service standards could be reduced.

3.3.3.2.2Poor customer loyalty. The business model is mainly directed at customers with planned needs who often have a fixed delivery fleet. But in order to attract customers, the platform have to reduce the customers' cost by providing subsidies. Once the platform stops providing subsidies for customers, customers tend to choose a long-term cooperative fleet.

3.3.4 Analysis of profits for Cloud Bird Distribution

At present, the main source of income for Cloud Bird Distribution is platform charges as well as some value-added services. However, its income is little in general. Providing additional value-added services will be the main direction for Cloud Bird Distribution to gain profits in the future.

3.3.5 Application conditions for Cloud Bird Distribution

Cloud Bird Distribution does not generally deal with urgent demands for vehicles. It mainly aims at planned vehicle usage of enterprises and only provides a whole-vehicle service.

3.3.6 Classification of Cloud Bird Distribution

Using the Internet, Cloud Bird Distribution integrates urban distribution capacity, and it uses a bidding system to serve customers with demands for urban distribution. With the vehicle-cargo matching system of Cloud Bird Distribution, the shipper places urban delivery demands on the logistics platform; the shipper indicates the duration, scope, and other details related to the transport capacity. According to the shipper's requirements, the platform with its integrated transport capacity makes a quote for freight demand. Users may directly see the quotation and previous users' evaluations

of drivers, which helps users select the most cost-effective vehicle to carry their goods by combining the service evaluation and price. Cloud Bird Distribution meets the customer needs by integrating transport capacity, and so we regard it as a virtual fleet system.

3.4 Analysis of Spider

3.4.1 Brief introduction of Spider

Belonging to Beijing Spider Logistics Information Technology Co. Ltd., Spider is an online-to-offline (O2O) enterprise that focuses on urban express delivery. Since it was formally launched in November 2014, Spider has aimed to reform and improve the efficiency of urban logistics. By means of the mobile Internet, Spider makes full use of the O2O system and integrates idle transport capacity. It changed the structure of the product and costs through an innovative model of volume accounting. The service scope and objects of Spider are very extensive; they include COD of mainline logistics companies, urban distribution using an e-commerce platform, distribution and allocation for chain stores, urban express delivery for specialized markets, and a series of individual customers and small businesses requiring urban delivery.

Spider currently provides services in eight cities: Beijing, Shanghai, Guangzhou, Tianjin, Shenzhen, Hefei,Jiningand Wuhan. It has more than 5,000 vehicles serving thousands of customers in Beijing every day. Both the number of orders and scale of its customers are rapidly increasing. Spider has also established cooperative relations with large fleets, and it has introduced the use of electric vehicles for carrying goods in Beijing, Shanghai, Guangzhou, and other first-tier cities. In the future, it aims to serve most of China's first- and second-tier cities[6].

3.4.2 Operation analysis of Spider

With Spider, users place orders through its Web site and WeChat of its vehicle-cargo matching platform for urban distribution. Users provide details about the size, type, and quantity of goods, the shipping address, the receiving address, the time of shipping, and the time of receiving; they then pay online. According to the size of goods, direction of distribution, distance between goods and vehicles, delivery time, and other factors, the system will push a delivery demand to a driver. Drivers distribute offline

[6] Data comes from an interview with a Spider representative.

and users evaluate online. The operation of Spider is depicted in Fig. 4.

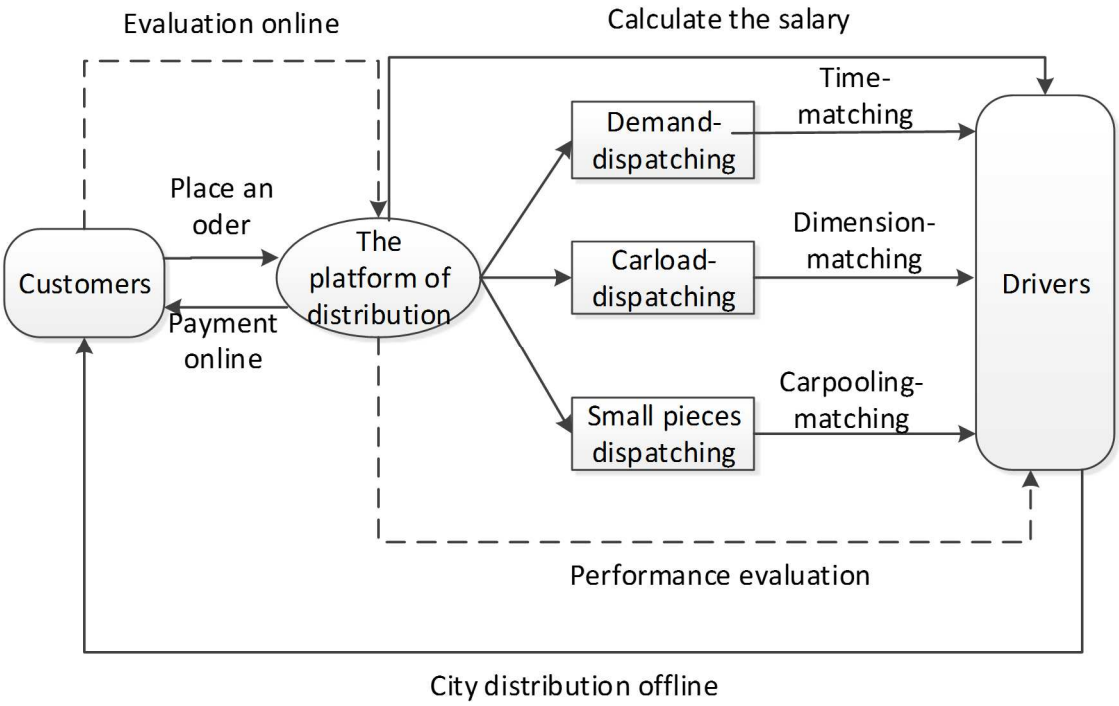

Fig. 4. Vehicle-cargo matching system of Spider

The whole vehicle is the minimum unit in the carpooling mode, and it cannot be rented. It operates in a similar manner to the warehouse principle with shipping. The space of the vehicle is arranged according to the volume of goods, and it is uniformly allocated by the system. Distribution vehicles can pick up and receive goods at multiple locations. Spider can achieve multi-loading and multi-unloading; it integrates idle transport capacity and optimizes costs and efficiency.

3.4.3 Advantages and disadvantages of Spider

3.4.3.1 Advantages

3.4.3.1.1Management of fleet. Unlike many companies that deal with centralized distribution, such as chain supermarkets, Spider does not own vehicles and does not have its own drivers; however, it provides distribution services for a whole city. With Spider, the vehicle is privately owned by the driver, which greatly reduces operating costs. Drivers can thus transport goods more conveniently and flexibly, which has benefits for transport efficiency.

3.4.3.1.2 Integration of vehicles and LTL distribution. Spider integrates vehicle and LTL distribution well, and it has accurately identified the market development point

with urban logistics. At present, the urban distribution of Spider mainly meets the needs of the urban door-to-door service market for medium-size and large cargos, such as lamps and furniture bought online. In addition, individual customers use Spider to deliver small items, such as keys; this kind of use is slowly increasing. With Spider, the ratio of vehicle delivery to LTL distribution is 9:1. Taking into account the LTL distribution of small cargos, Spider has more potential customers and greater market prospects than other urban distribution enterprises, such as Cloud Bird Distribution.

3.4.3.1.3 Platform under the closed-loop system. In contrast to most third-party urban distribution platforms, Spider provides platform services from the perspective of information integration; it also takes into account fleet integration management, vehicle-cargo matching, and transactions between drivers and shippers. It forms a closed loop of online orders, online payment, offline service, and evaluation. With this closed-loop system, Spider has established strict operation guidelines as well as rewards and penalties for the standard operation of drivers. Its supervision of capacity and feedback on operations has helped it achieve success in transport capacity and effect continuous improvement of its operations.

3.4.3.1.4Technology R&D and standardized charging. Compared with conventional O2O platforms, which simply subsidize drivers to attract merchants, such as HP(Hewlett-Packard Company), Spider pays more attention to technological R&D of its platform. In this way, it improves operations and the quality of products, which are part of the core competitiveness of its enterprise. Spider aims to increase delivery efficiency and reduce delivery costs, thereby aiming to win the favor of customers.

In terms of technology, Spider integrates idle transport capacity, and it relies on data mining and analysis to perform dynamic control and optimization. It can constantly make adjustments for changes in road conditions and drivers; in that way, it makes ongoing adjustments and optimizes operations. Spider improves the efficiency of distribution, and it reduces the no-load rate and logistics costs. Spider achieves multi-point delivery and intelligent routing, which means that vehicles can load and unload goods at multiple locations according to traffic situations; this ensures the highest dynamic loading rate, and it allows for adjustments in finding the best route in real time. Spider achieves its original intention of joint distribution: it makes full use of transport capacity, reduces distribution costs; it helps relieve road congestion and reduce environmental pollution.

With regard to the practice of subsidies in the O2O market, subsidies can temporarily make orders grow rapidly; however, once they stop, users discontinue using

the platform. Spider always focuses on profits. If an enterprise wishes to make profits, it has to undergo change. However, such change has to be standardized. Therefore, unlike other vehicle-cargo matching platforms, such as No. 1 Freight Car, Spider sets strict standards on product charges, and it rarely invests in subsidies for operation vehicles.

3.4.3.2 Disadvantages

3.4.3.2.1 Less urban coverage. Currently, urban distribution of Spider serves only around 8 first- and second-tier cities in China. It is necessary for Spider to increase its market coverage and open new markets.

3.4.3.2.2 Insufficient promotion. At present, Spider still uses the one-to-one promotion method in the market. This is very limited. Most of its promotion is directed at businesses, and the number of individual customers is relatively small. In terms of Spider's business, it mainly deals with large and medium-size items. The distribution market of small items has huge potential, but it is just beginning.

3.4.3.2.3Lack of standard evaluation mechanism. If there is no standard for evaluation, customers can easily post negative comments at random as a result of differences in customers and their requirements. Drivers are not subject to criticism. In addition, owing to differences in the nature of distribution goods, the requirements for distribution also differ; thus, it is difficult to standardize evaluation procedures.

3.4.4 Analysis of profits for Spider

There is a close relationship between the profits that Spider gains by fleet management and the fee settlement chosen by drivers. For drivers who choose "settlement by order" that is one of the settlement method, Spider generally receives a commission that is about 10% to 20% of each order by helping drivers find a shipper. Spider makes a profit through a referral fee. Specifically, For drivers who choose "settlement by chartering bus" that is also one of the settlement method, Spider makes a profit by wholesale and retail the vehicle capacity. Thus, Spider buys vehicle capacity for a certain period of time, which it then sells to the owner of the goods. The difference between buying and selling is Spider's profit.

Spider also provides personalized value-added services and uses the Internet to

achieve “freight carpooling” which means the drivers can accept several orders with similar paths at the same time, thereby improving efficiency and reducing costs. This is an additional source of revenue. However, with a growing number of imitators in the market, Spider must profit by providing value-added services and cater to diverse customer needs.

3.4.5 Application conditions for Spider

The most distinctive aspect of Spider is how it distributes goods using carpooling, its largest potential market is the customer-to-customer (C2C) business model. The economic basis of C2C depends on regional prosperity. This model also has high requirements in terms of logistics technology and basic equipment. Therefore, this system is more suitable for Beijing, Shanghai, Guangzhou, and other first-tier cities, which have logistic centers and trade centers.

3.4.6 Classification of Spider

Spider has enriched the whole-vehicle model with single loading and multi-unloading—more so than Blue Rhinoceros; it has integrated carpooling. It offers three kinds of urban distribution services. The first is delivery of small items. Spider aims at goods with small volume and low weight, which it implements by delivering goods together. The second is delivery according to demand. Spider takes into account the time of shipping and receiving, and it provides multiple deliveries to a single location. In its operations, Spider extends the range of idle capacity from the conventional notion of idle vehicles to the idle space within vehicles in transit; it fully considers utilization of idle capacity resources. This system was first developed by Spider, and we regard it as an integrated system of whole-vehicle service and carpooling.

4. Comparison of vehicle-cargo matching platform enterprises

The four vehicle-cargo matching platform enterprises described in section 3 represent four vehicle-cargo matching systems in China. Those enterprises are based on solving the problem of unbalanced supply and demand in the market; they address the issue of information asymmetry between distribution service demand and

distribution service providers. With each enterprise, the distribution service provider obtains relevant order information through the vehicle-cargo matching platform; the provider then completes the distribution service in the shortest time while satisfying customer needs. The whole process is tracked by LBS, which greatly improves the transparency of distribution and efficiency of the logistics chain. The operation of most vehicle-cargo matching platform enterprises is as follows. The platform finds a suitable vehicle according to the demand information, and it sends the relevant information to the driver. After the driver receives the order, the goods are delivered to their destination. Finally, the consignor completes the payment and evaluates the service of the driver.

To comprehensively analyze these four kinds of vehicle-cargo matching systems, we compared the vehicle-cargo matching platform enterprises in terms of several dimensions, such as target customers, distribution mode, ordering system, means of payment, pricing method, and profit point. The results appear in Table 1.

Table 1. Comparison of operation systems of the four enterprises

Enterprise	No.1 Freight Car	Blue Rhinoceros	Cloud Bird Distribution	Spider
Representative enterprise	Simple vehicle-cargo matching mode	Complete vehicle mode with single loading and multiple unloading	Virtual fleet mode	Integration mode of complete vehicle and carpooling
Target customer	Business customers	Business customers/Individual customers	Business customers	Business customers/Individual customers
Distribution mode	Vehicle transportation	Vehicle transportation	Vehicle transportation	Vehicle transportation and carpooling
Ordering mode	Mobile APP	Mobile APP	Mobile APP	Mobile APP/ WeChat/Website
Payment means	Cash payment	Online payment	Online payment	Freight collect/Online payment
Pricing method	Delivery	Delivery	Delivery	Volume/Delivery

	distance	distance/vehicle type	distance/Vehicle type	distance/Vehicle type
Profit point	Pay by driver	Platform charge	Platform charge/Value added products	Platform charge/Value added products

From Table 1, it is evident that integration of the whole-vehicle service and carpooling of Spider has certain advantages over the vehicle-cargo matching systems of the other three enterprises. Spider has a broader target area, which means that it has greater market applicability and can meet the needs of the distribution market at all levels. The distribution and pricing methods of Spider are more flexible and tend to attract more types of shippers. Spider has a more varied ordering system and offers more convenient use of its vehicle-cargo matching platform. It has a more comprehensive means of payment and can better adapt to the development of payment platforms in China. In addition, Spider has more profit points, which means it has a more stable income and better chances for long-term development.

Conclusions

The integration of whole-vehicle service and carpooling of Spider has certain advantages over the vehicle-cargo matching system of the other three enterprises. However, Spider still has some obvious problems, such as less urban coverage, insufficient promotion, and lack of a standardized evaluation mechanism. Those factors greatly limit the development of that system. In the market of vehicle-cargo matching, there are at present no enterprises like the taxi-hailing company Didi Chuxing. Although No. 1 Freight Car is mimicking the operation mode of Didi Chuxing, it still is in the developing stage and cannot form completely development mode. Thus, those enterprises need to consider the development environment, innovative operations, expanding profit channels, optimizing operations, and constantly improving their enterprise management so as to stand out among the fierce competition. Future research needs to examine the development direction and improvement conditions of various operation systems and offer specific development ideas and implementation plans.

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