A SYSTEMATIC DESIGN OF E-COMMERCE LOGISTICS FROM COLLABORATIVE MANAGEMENT THEORY PERSPECTIVE

by

HUAQIONG LIU

Philosophiae Doctor

(Project Management)

in the

Faculty of Engineering, Built Environment and Information Technology

University of Pretoria

Pretoria

Supervisor: Prof Leon Pretorius

Second Supervisor: Dr.Dongdong Jiang

2020

A SYSTEMATIC DESIGN OF E-COMMERCE LOGISTICS FROM COLLABORATIVE MANAGEMENT THEORY PERSPECTIVE

by

Huaqiong Liu

Supervisor: Prof Leon Pretorius

Second Supervisor: Dr.Dongdong Jiang

Department: Department of Engineering and Technology Management

UNIVERSITY OF PRETORIA

Degree: PhD

In the 21st century, e-commerce (electronic commerce) has witnessed explosive development, while the problems such as the imperfect logistics system and backward information platform exposed are also increasing. This research thesis focuses on the design of electronic commerce project logistics under collaborative theory. Firstly, this research analyses the current situation of e-commerce, and explains relevant theories of system engineering and collaborative theory. Secondly, a management framework of e-commerce under collaborative theory is discussed. Then it is about the construction of a new and novel logistics system, that is, a four-stage radial-spoke logistics network containing e-commerce hubs, e-commerce regional distribution centres, e-commerce physical stores, and e-commerce cooperatives. The existing logistics mode is innovated and developed with the "collaborative distribution" mode proposed, and the entire supply chain is connected through the four-stage radial-spoke logistics network, enabling all parties involved in the supply chain to achieve collaboration. Then based on the network, containers are differentiated and standardized into four classes. What's more, with the design and development of a collaborative logistics system, this thesis presents countermeasures to integrate e-commerce with its internal management platform. So the growing information is effectively managed, timely and correct decision-making information and decision support are provided. Furthermore, previous e-commerce platform is strengthened and the collaborative theory is fundamentally applied in a novel context. Finally, combining together logistics alliance, e-commerce platforms as well as its management system, this research is aimed to improve e-commerce collaborative management and promote e-commerce collaborative theory.

Key words

Electronic commerce; Collaborative theory; Logistics system; Standard LCL box; Big data platform.

Acknowledgements

I would like to thank the following individuals for their support during the completion of this work:

Prof Leon Pretorius and Dr. Dongdong Jiang have shown enough patience and given me scientific guidance on my academic work during my study at the University of Pretoria in the past three years. Their valuable feedback on the journal articles and conference papers were highly appreciated. I would also like to express my gratitude to Prof He, Prof Sun and Prof Meng, from Shandong Jiaotong University and Shandong University for providing me convenience and assistance when doing some of the research in China.

My heartfelt thanks go to all my dear family members in China and South Africa who have provided me with moral support, especially to my wife for her continuous support in my daily life.

Contents

List of figures

List of tables

List of acronyms

B2B: Business to Business

B2C: Business to Consumer

C2C: Consumer to Consumer

EDI: Electronic Data Interchange

C2B: Consumer to Business

O2O: Online to Offline

LCL: Less than Container Load

BAB: Business Agent Business

DSM：Design Structure Matrix

GDP: Gross Domestic Product

GPS: Global Positioning System

RFID: Radio Frequency Identification

AGV: Automatically Guided Vehicle

CPFR: Collaborative Planning, Forecasting and Replenishment

COD: Cash on Delivery

WMS: Warehouse Management System

FMCG: Fast Moving Consumer Goods

BACKGROUND AND CONTEXT

Since the 21st century, e-commerce (electronic business), especially B2C (business-to-consumer) e-commerce, has developed more and more rapidly, which has become a major force to promote online electronic transactions. At the same time, consumers are making higher requirements for the service provided by e-commerce enterprises. Statistically, consumers' complaints about e-commerce are mainly from terminal logistics distribution. According to surveys, the sorting, packaging and handling efficiency during the process of warehousing, as well as the investment of e-commerce enterprises in logistics information technology have greatly affected the efficiency of logistics distribution. The subject studied in this research thesis is exactly the construction or fundamental development and design assessment of an e-commerce logistics system under collaborative theory. It comprehensively analyses the advantages and disadvantages existing in the logistics systems of e-commerce enterprises, and based on collaborative theory, finds the bottleneck in logistics that hinders the development of e-commerce enterprises; so it strives to create a logistics system that is more collaborative with e-commerce. Besides, with more investment in information technology, the misgivings of e-commerce enterprises may be dispelled.

According to China's national conditions, logistics modernization in China cannot be achieved overnight. However, e-commerce has developed in leaps and bounds. So it is clear that current logistics operations cannot meet the requirements of e-commerce enterprises. With the development of e-commerce, logistics enterprises are continuously making progress: developing information technology and improving distribution networks. In turn, the operation of logistics enterprises may directly determine the business reputation of e-commerce enterprises, and even affect their future strategic development. So the two sides above are mutually reinforcing, complementary but also mutually restrictive. Only by knowing and considering the current situations of the two sides and making full use of the available social resources can people provide better services of higher quality and at lower cost.

Firstly, this research thesis analyses the current situation of e-commerce and explains related theories of system engineering and collaborative management. Secondly, the management of e-commerce under collaborative theory is discussed. Then it is about the construction or development of the logistics system, that is, the construction of a four-stage radial-spoke logistics network containing e-commerce hubs, e-commerce regional distribution centres, e-commerce physical stores, and e-commerce cooperatives. The existing logistics mode is innovated and developed with the raising of the "collaborative distribution" mode, and all parties involved in the supply chain can realize collaborative operations by the construction of the four-stage radial-spoke logistics network, which can improve logistics efficiency. Then based on the network, containers are differentiated and standardized into four classes. What's more, with the construction of a collaborative logistics system, this thesis presents countermeasures to integrate e-commerce with its internal management platform. Finally, combining together logistics alliance, e-commerce platforms as well as its management system, this research is aimed to improve e-commerce collaborative management and promote e-commerce collaborative theory. Based on the existing e-commerce network platform, the big data platform is improved and developed. The collaboration of the information platform and the logistics system helps to effectively manage the ever-growing information, which will boost the interconnectivity and collaboration of all parties involved in the supply chain. Moreover, the collaborative management of the information platform will help to promote e-commerce collaborative management, thus deepening the development of e-commerce collaborative theory.

The establishment of the four-stage radial-spoke network will promote the development of the whole supply chain and bridge the gap between the first and last mile delivery, thus connecting the whole supply chain. With the radial-spoke logistics network, the logistics distribution mode is innovated, the logistics distribution channel integrated, and collaborative distribution established, thus improving logistics efficiency and achieving resources sharing and economies of scale. Therefore, the collaboration among all the parties involved in the supply chain will be strengthened, logistics efficiency improved, and customer satisfaction with e-commerce enterprises increased. Meanwhile, containers are divided into four classes, which will save the time and costs for sorting and loading, and improve the efficiency of logistics operations, facilitate container management, and strengthen transportation safety. Besides, various data will be processed through big data platform in which the e-commerce enterprises are experts, and the problem of "information island" can be avoided so that communication among all parties can be strengthened and logistics efficiency be improved.

Finally, based on the potentially available resources in China, the application of convenience stores in the terminal distribution of e-commerce logistics is put forward to achieve better performance of last mile delivery and enhance customer satisfaction, which innovates the terminal distribution for e-commerce enterprises. This research is intended to strengthen the e-commerce management under collaborative theory and realize the promotion and publicity of the e-commerce collaborative theory in the country. The application of collaborative theory will help to remove the barriers preventing the development of e-commerce logistics and achieve the integrity of the e-commerce logistics system.

Chapter 1:
Introduction

1.1 Research background and significance

1.1.1 E-commerce and e-commerce logistics

With the revival of the global economy, e-commerce has developed rapidly, and society informatization has led to the rapid expansion of e-commerce also in China. The rapid development of the Internet has made possible the worldwide and net-based e-commerce. Nevertheless, rapid development tends to come along with a series of risks, mainly including risks in the aspects of logistics, information, credit, management, transaction, and so on. Given the importance of logistics in e-commerce, risk in logistics is the primary risk that e-commerce is facing. (Zhang et al., 2008; Zhu et al., 2014; Trautman, 2017)

The research on e-commerce logistics under collaborative theory will bridge the gaps in e-commerce in terms of time and space, and provide possible solutions to the better performance of the first and last mile of delivery. Also, this research will help to achieve real-time interaction of both logistics and information, and it lays a theoretical foundation for better collaboration of all parties. (Liu et al., 2015; Zhang et al., 2017; Sun et al., 2015).

As an emerging industry, logistics is developing rapidly. Since some major industries cannot make further progress without the support of the logistics industry, logistics has become an indispensable part of social life. It plays an increasingly important role in developing national economy and even global economy. (Goh et al., 2003; Qian et al.,2013; Guo et al., 2010). Economic booming in China in recent years presents new opportunities for logistics development and also for e-commerce development. The collaboration of all parties involved in supply chain has become an important factor in e-commerce logistics.

Some of the main problems identified are as follows (Ying et al., 2017; Zhang et al., 2017)

1.1.1.1 Supply chain is not connected

Nowadays, the whole supply chain network of e-commerce is connected intermittently or even disconnected. This situation results in information blocking between supply chains, poor communication, and response delay to changes of customer demands. There are many cases in which supply chains cannot fully communicate. (Yao, 2005; Ying et al., 2016; Lamba et al., 2019).

1.1.1.2 Logistics network layout is incomplete

E-commerce network now covers only 90% of the key cities in China. Remote areas like Tibet, Xinjiang with a relatively harsh environment and lower economic level, as well as some towns and villages have not built up adequate transportation networks, so goods cannot be delivered directly (Wang et al., 2015; Xu et al., 2013). According to the sixth national census in China, rural population accounts for 50.32% of the total population.（Zhu, 2011; Duan et al., 2013）. Due to the large proportion of rural residents in China, the development of logistics enterprises will be limited.

1.1.1.3 Improper connection between line haul and feeder service

For the reason that a complete logistics transportation network has not been established in China , further feeder service cannot be carried out after the e-commerce goods are transported to the distribution centres through the line haul (Fleischmann, 2003; Heskett, 2013; Lin, 2013). In addition, the connection between line haul and feeder transportation service is improper in some regions (Mistro et al., 2015; Chueh et al., 2011). This results in waste in human resources and sorting time, and lowers customer satisfaction.

1.1.1.4 Inefficiency of terminal distribution system

In terms of terminal distribution, logistics enterprises are faced with serious problems. Extra time and human resources have been wasted in terminal distribution, which greatly reduces the transportation efficiency.(Miao et al., 2018; Zhu et al., 2014)

1.1.1.5 High empty-loaded rate

Due to the imperfect information system, the empty-loaded rate of logistics vehicles is increasing. At present, the empty-loaded rate of logistics vehicles in China is as high as 37% (Prasanna et al., 2012; Xiong et al., 2016; Zhou et al., 2013). Excessively high empty-loaded rate will increase logistics costs and reduce the utilization rate of logistics.

1.1.1.6 Poor Connection of transport vehicles

In the process of transportation, all the franchised vehicles cannot be connected with logistics enterprises, which results in serious lag in transportation time, more difficulties in transportation, and lower customer satisfaction (Grbovic et al., 2016). In the meantime, goods and vehicles are matched on the spot during the transportation process, wasting a lot of transport capacities and time (Jung et al., 2017). In terms of dispatch of vehicles, the monitoring system of the franchised vehicles cannot be matched with the internal monitoring system of logistics enterprises, which brings problems to the management of the franchised vehicles. These franchised vehicles may cause losses instead of generating profits (Akter et al., 2016). Therefore, the match and connection between franchised vehicles and the internal system of enterprises is also a major problem to be handled (Bayles et al., 2001; Jian et al., 2012; Yu et al., 2017).

1.1.2 Classification of e-commerce

At present, the simplest way to classify e-commerce is by transaction object and accordingly e-commerce can be mainly divided into business-to-business e-commerce (B-to-B), business-to-consumer e-commerce (B-to-C), and consumer-to-consumer e-commerce (C-to-C) (Ngai et al., 2002).

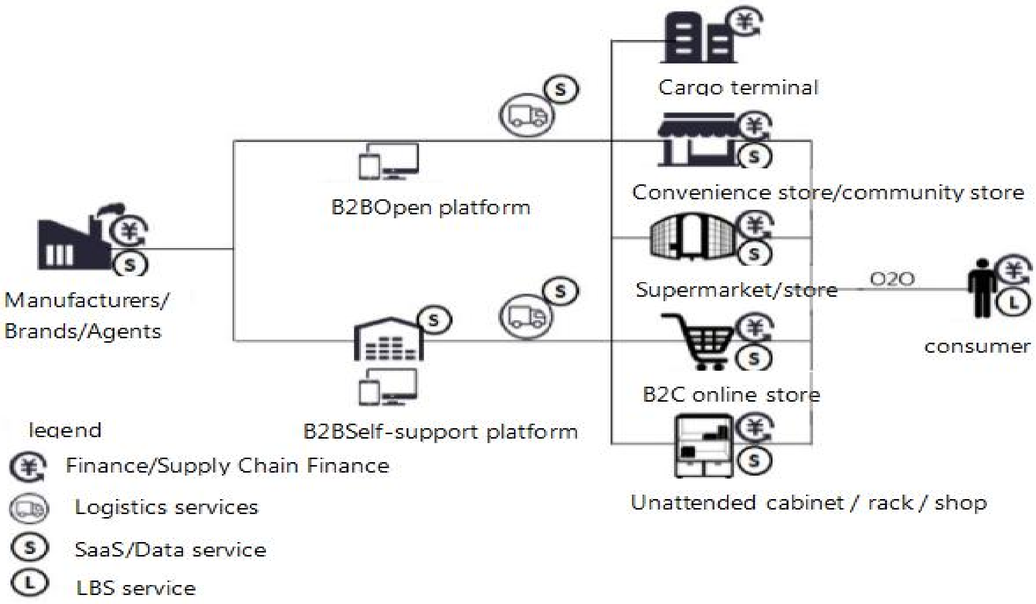
This kind of classification has been widely accepted in previous years. B-to-B e-commerce appeared many years ago. This model is similar to large-scale wholesale trade. Enterprises organically integrate the supplier-oriented purchasing business with the sales service for downstream agents through their internal information system platforms and external websites (Rayed et al., 2017). It is the direct reflection of the offline production, supply, and sales of enterprises. The B-to-B model takes place among enterprises, and manifests the following advantages: parties involved are specific; transaction process is standardized; transaction amount is high but logistics cost is low; and the distribution channels are relatively mature (Grbovic et al., 2016). Also, it is well developed in the way of purchasing and way of payment. So it is of great importance. In this business model, ordering, signing as well as sending of documents and payments between large enterprises are all finished online (Wamba,2012; Ling et al., 2014). Particularly, through Electronic Data Interchange (EDI) in value-added networks, this model changes radically the planning, production, sales and operational patterns of enterprises, and even the basic production mode of the whole industry (Ladan et al., 2014). Therefore, more and more attention has been paid to this kind of e-commerce business model (Lefebvre et al., 2005). It is considered by many in the industry as an important model for the future development of e-commerce (Li et al., 2015; Nie et al., 2012).

B-to-C e-commerce refers to transactions between businesses and consumers. This model is similar to retail business. B-to-C is the most common way for ordinary people to access to the Internet. Regardless of the transaction mode, all transactions are ultimately between enterprises and consumers (Dan et al., 2005). Large consumer groups have the potential to generate huge profits. This kind of e-commerce is mainly online sales made by enterprises through the Internet. In recent years, this kind of e-commerce has experienced relatively rapid development, for the Internet has created new transaction platforms for enterprises and consumers (Herrero Crespo et al., 2010; Chirkin et al., 2014). For most consumers, it is not necessary to standardize the sending of documents. And the searching and browsing function and multi-media interface on the Internet have made it easier for consumers to search for and know more about what they want (Fan et al., 2016). However, B-to-C faces bottlenecks in terms of security certification, electronic payment, net speed and cost, and delivery and after-sales service. B-to-C pursues a point-to-plane distribution (Lee et al., 2012). The amount of each transaction is low and the scale of goods delivery is small, which greatly increases the difficulty of distribution (Sun et al., 2011; Yuan et al., 2011).

The main form of C-to-C e-commerce is auction websites which are equivalent to large bazaars without specific goods and prices (Oreku , 2013; Calderwood, 2016). C-to-C operators set up platforms on the Internet to bridge the buyers and sellers and deduct a percentage from each deal closed. Due to the particularity of second-hand goods, C-to-C operators usually do not provide logistics and distribution services. Instead, the buyers and sellers negotiate through the Internet and decide on the way of payment and delivery by themselves (Bai, 2017). A successful C-to-C transaction depends largely on the good faith of both buyers and sellers. This model is suitable for the consumers who have no clear buying goals and simply enjoy doing shopping.(Li, 2016)

In Figure 1.1, the supply chain of B2B and B2C and their differences can be clearly displayed.

Figure 1.1 B2B e-commerce supply chain (Karthik et al., 2009)



In recent years, a variety of new e-commerce models have emerged (Lopez-Nores et al., 2013; Tan et al., 2010; Zhou et al., 2010). For example, C2B (Consumer to Business.) is e-commerce between consumers and businesses. Usually consumers customize products and price according to their own needs or actively participate in product design, production and pricing, while manufacturers produce the customized products (Kawa et al, 2016). O2O (namely Online to Offline) is e-commerce combining online and offline services. O2O connects the online shops with the physical stores perfectly through online shopping guides, and connects the virtual Internet to the real world. It not only allows consumers to enjoy the online preferential price, but also enjoys offline intimate service (Shankar et al., 2017). One typical O2O enterprise in China is online furniture seller Merlot who started to carry out O2O by combining its online furniture shops and offline exploration halls in the earlier time and now has become mature in operation (Liu, 2012; Ma, 2012). BOB refers to an e-commerce model in which the suppliers and purchasers make goods or service transactions with the help of operators (Austan et al., 2018). The core of BOB is to help those SMEs or channel vendors with brand awareness obtain the opportunity to build their own brands and achieve their own transformation and upgrading. The BOB model is a brand-new e-commerce model promoted by Zoom Interactive (Chen, 2014), a company in China. It changes the former and fixed mode of e-commerce and promotes the transformation from e-commerce platform to e-commerce operation (Mayuri et al., 2017). Different from previous business models, such as C2C, B2B, B2C and O2O, it fulfils and upgrades five major operational functions: brand operations, store operations, mobile operations, data operations, and channel operations in e-commerce and industrial operations (Liu et al, 2016; Peterson et al., 2017).

With the development of e-commerce, a variety of new combinations and models will spring up between trading entities like producers, distributors, consumers, intermediaries and the government. However, the ultimate goal of enterprises is not to classify e-commerce models or choose only one model. Actually many enterprises do not adopt one single business model (Wilson et al., 2007; Zhou et al., 2010). The goal of an enterprise is to improve its profitability by modern means. It is necessary for enterprises to choose the suitable models according to their actual conditions and advantages (Rita et al., 2017).

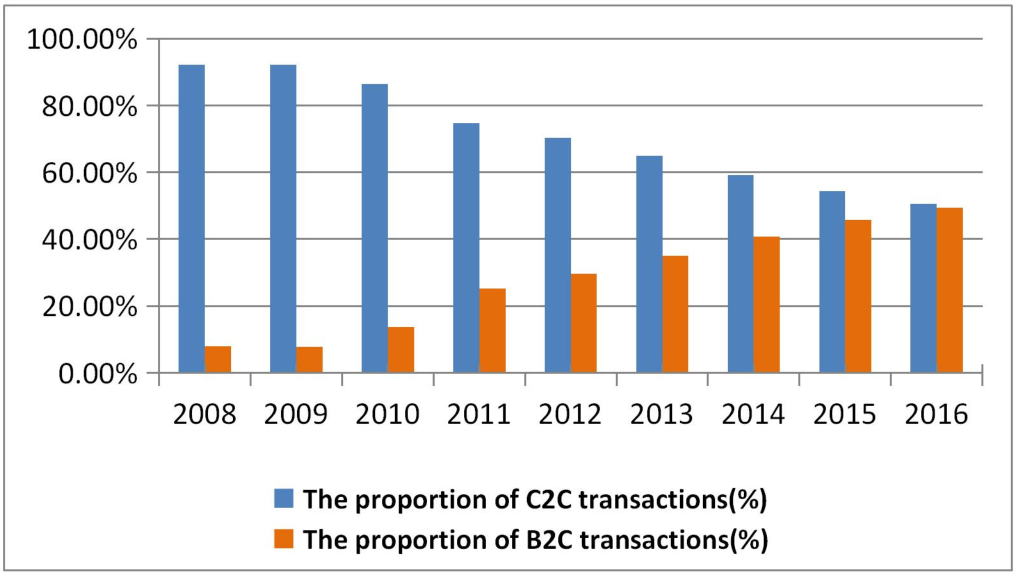
1.1.3 The status quo and development of B to C e-commerce

1.1.3.1 Development situation

China's B2C e-commerce has been developing at a rapid pace in the past few years so that it has increasingly become the pillar of the e-commerce in China.

Figure 1.2 reflects the scale of B2C e-commerce transactions in China's online shopping market in recent years. (Akter et al., 2016)

Figure 1.2 China online shopping market transaction scale structure (2008-2016) (Zhao, 2011)



B2C e-commerce has achieved remarkable success in businesses from commodity sales to supporting services, but it still leaves much to be improved. Overall, it has the following characteristics (Zhu et al., 2016).

The number of B2C e-commerce websites continues to increase and products have changed to be more diversified, from simple and easy-to-describe products, such as audio electronic products and books, clothing and daily necessities, to all kinds of products. Consumers can buy most what they want through online shopping (Mokhtarian 2004). However, the quality control of products sold on these websites is poor and inadequate in general. Some clothing, shoes, small household appliances, communication equipment and other daily life products still have quality problems (Lerche et al., 2016).

The logistics distribution that is compatible with the development of e-commerce has been greatly improved (Hakey et al., 2012). Whether the B2C websites choose to build its own logistics system or choose to cooperate with third-party logistics companies, they have made continuous efforts and significant progress in improving consumer satisfaction (Wu, 2016; Babur et al., 2017). However, there are still problems existing: low-level standardization of logistics and distribution, poor quality of logistics service, delivery delay during busy time, and even loss of goods (Masmoudi et al., 2013; Zhao et al., 2010).

The emergence of various online payment methods (Sorkin 2002; Mishra et al., 2017; Xu, 2018) and the continuous improvement of payment technology make online shopping more convenient. At the same time, how to ensure online payment security has become a major issue hindering the development of online payment (Polasik et al., 2010; Wang et al., 2019).

B2C e-commerce after-sales service system is more and more complete, and more and more e-commerce enterprises have laid emphasis on after-sales service and customer satisfaction. More than 60% of them have been committed to after-sales service (Zuo et al., 2013; Bi et al., 2014; Zhao et al., 2013).

As for consumers, more and more people choose to do shopping online and the online consumer group as a whole presents the following characteristics: the proportion that male online shoppers account for is increasing year by year; more and more online shoppers are from higher age groups (Wang et al., 2016); middle-aged and aged netizens do online shopping more frequently; online shoppers are mainly with middle or higher educational degree as before, but the educational background gap has narrowed; the income structure of the online consumer group is turning to the mid-to-high end (Hu et al., 2018).

In terms of market competition, B2C e-commerce, according to service providers, can be divided into two types: self-selling B2C e-commerce and third-party platform B2C e-commerce (Rahi et al., 2016). Self-selling-style website is an e-commerce website designed by enterprises to serve for the enterprises themselves, such as Vanke Eslite, Jingdong Mall, Dangdang, Amazon, Suning, Weipin Club (Zhang et al., 2013; Xie, 2017). In third-party platform B2C e-commerce, e-commerce enterprises such as Taobao Mall design websites and create transaction platforms for third parties. In order to diversify commodities and make better use of their website resources, some self-selling B2C enterprises begin to open B2C online shopping platform (Holsapple et al., 2005; Ding, 2017; Li et al., 2017). For example, JD.com, Dangdang, Amazon.www, etc. have successively opened third-party platforms. While doing their self-operated business, they are also engaged in third-party platform business. According to statistics, products from global third-party sellers have exceeded 30% of the total commodities sold by Amazon (Angel et al., 2008). Third-party sellers have become an important part of B2C e-commerce.

1.1.3.2 The development trend

(1) Offline enterprises extend to B2C e-commerce

The tremendous development of B2C e-commerce and its bright prospects for development not only enable Jingdong Mall, Dangdang, Tmall. www, and other e-commerce website operators to make huge profits, but also make offline enterprises realize the vast potential of e-commerce (Hjort et al., 2016). As offline companies, such as Suning Appliance and GOME, have set up their own B2C e-commerce websites and achieved good sales figures, it will be a trend for future B2C e-commerce development that conventional offline enterprises will start up their own online businesses. Offline enterprises have advantages in engaging in B2C e-commerce (Ni et al., 2017). Firstly, offline enterprises have many outlets, and their whole industry chain is mature. So they can take advantage of their downstream industry chain to develop online business (Huang et al., 2010; Li et al., 2017; Ding, 2017). For example, they can purchase goods with competitive advantages and they have mature logistics distribution system and after-sales service system. In addition to home delivery service, they can also give full play to their outlets so that consumers can go to the nearest outlet to pick up their items (Tadelis, 2016; Zhou et al., 2018). Secondly, large-scale offline business will bring considerable online customers and online and offline activities going side by side will add websites hits, increase user’s loyalty, and make up for the deficiencies of online service (Cao et al., 2016). Therefore, the transition from offline businesses to B2C e-commerce is the result of the integration of upstream and downstream e-commerce industry chain and is also in line with the trend of diversified development of e-commerce (Hawk, 2004).

(2) Integration of B2C e-commerce service and B2C platform service

Initially, e-commerce websites used to run B2C e-commerce business and sell proprietary products to make profits comprehensively. However, when B2C e-commerce business websites have developed to a certain extent, some of them began to open their website platforms and cooperate with other brand manufacturers and franchisers to achieve win-win (Gonalves et al., 2016). For the entering enterprises, by selling products on relatively mature and well-known B2C e-commerce websites, they can not only save the money of opening a website their own and technological investment, but also make full use of the warehousing and logistics system, payment system, and after-sales service system of the e-commerce platform websites (Kim et al., 2009). For the B2C e-commerce websites, expanding its product coverage by themselves will easily lead to redundant internal organization and great operating pressure. With the entering of brand manufacturers and franchisers, they can diversify their commodities and offer more choices for consumers (Houde et al., 2017). At the same time, they can reduce operating costs by sharing the investment in logistics system and technology with these entering brand manufacturers.

(3) Transition of vertical B2C website to comprehensive B2C website

The vertical B2C website is characterized by deepening operation in a certain industry or market segment (Xie, 2017; Zhu, 2018). In view of this feature, vertical B2C e-commerce just focuses on a specific industry or market segment and is aimed to be the leader and expert in the industry. So it can provide the consumers with more specialized and detailed choices at favorable prices (Cui et al., 2017; Palese et al., 2018). However, seeing from the development history of B2C e-commerce websites, vertical B2C e-commerce is usually considered as springboard of B2C e-commerce enterprises in the initial period of founding (Yu et al., 2011). Once the business is relatively stable and the market share increases, large vertical B2C websites will present a trend of the transition to a comprehensive B2C websites. Many e-commerce enterprises, such as Jingdong Mall, Dangdang, and Suning. www.,(Ding et al., 2017; Li et al., 2017) have gradually made transition from the initial vertical B2C websites to comprehensive B2C websites.

The core of the vertical B2C website lies in its specialization. If a vertical B2C website fails to achieve specialization in a certain industry, it will be difficult to highlight its features and advantages. In addition, vertical B2C websites usually cannot afford large capital investment and costs of advertising and the construction of logistics and warehousing systems (Rahayu et al., 2017). If they cannot make innovation in marketing channels and strategies, it will be very difficult to overcome the threat posed by comprehensive B2C websites and gain their footing in e-commerce competition (Singh, 2002).

Judging from the long-term development of B2C e-commerce, it is an inevitable trend for B2C industry to turn to vertical segmentation. However, faced with the increasingly fierce e-commerce competition, some vertical B2C websites have gone bankrupt (Hou, 2012; Sahi et al., 2013) because of capital chain ruptures before they can explore further into the industry and break new ground in sales strategies. For the vertical B2C websites that can successfully receive capital injections, they are still expanding their scales. It can be predicted that in order to occupy the B2C e-commerce market, even the strongest B2C website will turn to the transition to a comprehensive B2C website under the pressure of logistics construction. If a vertical B2C website wants to be the leader of the industry, it has to face the challenges brought by after-sales service after its scale development, and it has no choice but to build logistics system by itself (Kang et al., 2014; Wang et al., 2014; Masudin et al., 2016).

1.1.4 Logistics supporting the development of e-commerce

Sound logistics infrastructure is needed to support the rapid development of e-commerce. With the advancing society, logistics industry has not been restricted to its singular function of transporting service but has become important pillar of economic transformation (Alnawayseh et al., 2013; Huang et al., 2014).

Chinese consumers will place greater emphasis on the capabilities of e-commerce enterprises to provide logistics service and other value-added services. Only with the construction of logistics infrastructure can the logistics industry have the basis and momentum for long-term development.

Although the existing logistics infrastructure in China has been developing, it is still relatively backward due to various reasons: lack of a unified planning of logistics and warehousing infrastructure and an efficient logistics data platform, which have resulted in non-standard information channels and low efficiency of logistics operations in the whole society (Zhao et al., 2010; Bensassi, et al., 2015; Zhang et al., 2016). So there are problems of insufficient social logistics demand and insufficient supply capacity of specialized logistics existing simultaneously. With high empty-loaded rate of franchised logistics vehicles, these problems have caused a lot of resources waste. The ratio of total social logistics costs to GDP in China is about twice of that in the developed countries (Giuffrida et al., 2016).

In order to change this situation, the government should increase investment in logistics infrastructure and then encourage the willing and capable enterprises to invest in the construction and operation of logistics infrastructure. At present, many enterprises have already actively invested in logistics industry. For example, the Cainiao Network (Zhao, 2016; Liu, 2017) created by Alibaba Group and many partners in the industry is making active attempts and explorations. The Cainiao Network is going to establish “open and socialized” logistics infrastructure throughout the country within 2 to 5 years, and build “China Smart Logistics Network” by means of cloud computing and the Internet of things, thus achieving 24-hour delivery in China (Wang et al., 2018; Li et al., 2019).

In order to accelerate the development of e-commerce logistics system it is also important to strive to develop socialized logistics, improve resource utilization, and enhance industry data application and information system management. It is important to promote openness and cooperation among logistics enterprises, improve resource utilization, and encourage the development of informationalized logistics platforms (Yu et al., 2016). Through collection and application of information, such as third-party express delivery information and warehousing information, the e-commerce merchants are provided with comprehensive information, such as information about storage, delivery of goods, and self- picking up of items, which not only promotes the efficient coordination of social resources and enhances the quality of socialized logistics services, but also helps to create future commercial infrastructure.

1.2 E-commerce and problems of logistics supporting e-commerce development

In view of the above discussion, the PEST-SWOT analysis method is employed and then the evaluation matrix of B2C e-commerce is obtained and shown in table 1.1:

Table 1.1 PEST-SWOT Evaluation Matrix for B2C E-commerce (Pan et al., 2009)

Project	Political Factors	Economic Factors	Social Factors	Technical Factors
Advantages	1."Internet Plus" helps logistics electronic platform construction. 2. Central government and local governments provide policy support.	1. Low cost of infrastructure construction and wide business scope. 2. Realization of direct one-to-one sale and reduced operating costs	1. Quick and convenient service. 2. Advantage of service increases.	1. Increasingly advanced logistics. 2. Convenient roads, railways and air transportation. 3. Increasingly

		and prices.		advanced information and electronic technologies.
Disadvantages	Imperfect logistics evaluation standards and system, lack of relevant laws and regulations.	1. Excessive attention to price affects the profits of B2C enterprises. 2. Without better value-added services, it is difficult to attract consumer groups.	Staff with different educational background and lack of comprehensive, professional technical personnel.	Incomplete logistics and distribution, backward delivery and high cost.
Opportunities	1. The government has introduced relevant policies. 2. The country attaches importance to the development of e-commerce.	1. Affected by the global financial crisis, the government has actively taken various measures to expand domestic demand and ensure growth. 2. The IT industry, information industry and logistics industry have begun to integrate resources.	1. Satisfying the personalized needs of customers and bringing great convenience to people's lives. 2. Tapping potential business opportunities, and gaining benefits.	1. Website construction and information technology have made great progress, and the application of new technologies is gradually increasing. 2. The joining of third-party payment vendors and the cooperation between banks and B2C companies help to guarantee the security of online payment.
Challenges	Imperfect regulations on network security	The market competition is intensifying and the funds of	The social credit environment is poor and the entire social credit	1. Online products have potential security

	and e-commerce.	logistics construction are insufficient.	system is still not perfect.	risks. 2.Database server security needs to be protected

Problems of logistics supporting e-commerce development:

1.2.1 Higher requirements for the personalization of e-commerce logistics distribution

At present, the e-commerce logistics distribution, characterized by online shopping, imposes higher requirements for the "personalization" of distribution services, especially of the last-mile delivery service.

1.2.2 High empty-loaded rate

Due to the imperfect information system, the empty-loaded rate of vehicles is increasing. At present, the empty-loaded rate of logistics vehicles in China is as high as 37% (Ren et al., 2015; Yu, 2015; Wang et al., 2019). Excessive empty-loaded rate will add logistics costs and reduce the utilization rate of logistics, which is harmful to logistics enterprises.

1.2.3 The large number of small-scale orders of the e-commerce logistics distribution.

Another feature of online shopping e-commerce logistics distribution is the large number of small-scale orders. Due to so many single buyers, the scale and quantity of each order in online shopping is usually small, which poses a great challenge to the distribution by enterprises. In particular, the cost of small-scale distribution will increase significantly (Pan et al., 2009; Sun, 2015; Ming, 2017). How to organize small-scale and personalized distribution is a major problem for e-commerce distribution.

1.2.4 Timeliness of e-commerce logistics distribution

The priority should be given to the enjoyable experience of consumers in e-commerce logistics delivery. Customers order goods online and hope that the goods will be delivered within their expected time. So they have high requirements for the timeliness of delivery (Chen, 2014; Sui et al., 2015; Liu et al., 2016). For example, some consumers prefer home delivery service and expect the goods to be delivered on weekends or in the time when they have come off duty. Some customers may allow their goods to be sent to their workplaces. However, it often occurs that the consumers fail to sign for the goods in the case of being temporarily absent from workplaces, thus causing a wasted trip of delivery staff and bringing about a substantial increase in delivery costs.

1.2.5 Inability to integrate resources effectively

E-commerce enterprises should integrate a large amount of social resources to support their own development. But, many e-commerce websites fail to do that, causing waste of online resources. In the “Internet Plus” era, most B2C enterprises are not good at online business (Wang et al., 2009; Zeng, 2016; Ji et al., 2017). To enhance the operation of the enterprises, it is primarily to improve and perfect the information system.

1.3 Description of the research issues

Based on the above background analysis, the logistics system for e-commerce under collaborative theory will be built. E-commerce is developing fast nowadays but relevant issues are arising. The specific issues are as follows:

1.3.1 The proposal of the e-commerce collaborative theory

In order to meet the requirements of environmental changes, the key to survival and development of e-commerce enterprises is to have competitive advantages over other competitors. The so-called competitive advantages can be illustrated in this way: enterprises can provide customers with more value than their competitors in the operation of specific businesses (Nof, 2007). These customers are willing to purchase the higher values when they recognize that the company offers equal benefits to the customer at a lower price than any other competitors or offers unique benefits far beyond the higher prices. E-commerce enterprises need to be properly positioned in the market, in order to possess special and superior resources and pursue human resource management and enterprise culture. In this case, exploring “collaborative management” will help e-commerce enterprises to stand firm in the tide of the times (Colfer et al., 2005; Pan, 2016; Wang et al., 2018).

1.3.2 Collaborative management

Generally speaking, when making and implementing the plans of a project, checking all kinds of resources and making a work list is the starting point, but that may make people too entangled in trivial details to see the project from an overall view. (Katon et al.,1995; Wang et al., 2013; Zhang et al., 2016). However, with collaborative management introduced in e-commerce project, the wholeness of a project will not be ignored.

1.3.3 Establishment of e-commerce logistics system

A four-stage radial-spoke logistics network mainly includes: e-commerce hub centres (for line haul transit transportation), e-commerce regional distribution centres (for further sorting and processing), e-commerce physical stores (urban distribution centres, convenient for transit), and e-commerce rural cooperatives (the terminal of the delivery of the goods and the starting point of the goods collection). Through the establishment of the aforementioned logistics network, it can truly get through the "first mile" and "last mile" delivery and provide nationwide one-stop e-commerce distribution services.

1.3.4 Standardized LCL box and drop-and-pull transport in e-commerce

Standardizing LCL box meets with the call of transport standardization in the country. Standardized box is not only more convenient for subsequent transportation and connection between vehicles, but more suitable for more types of vehicles and in more situations, thus avoiding multiple sorting and improving sorting efficiency. The perfect combination of drop-and-pull transportation and the application of standard LCL boxes can improve the utilization of standard LCL boxes and allow them to be used both in line haul and in terminal delivery, so the drop-and-pull transport can be applied in both line haul and terminal delivery as well (Wen et al., 2014; Wang et al., 2014; Zhang et al., 2017)

1.3.5 Establishment of a cloud platform

The establishment of an e-commerce cloud platform not only enables all parties involved in supply chain to share information, but also makes a great contribution to the study of e-commerce collaborative theory (Mengke et al., 2017). The establishment of the cloud platform enhances the linkage of the entire e-commerce logistics system, breaks the time-and-space barriers in logistics process and greatly improves logistics efficiency. The cloud platform is the transformation and development of the existing e-commerce platform, integrating the logistics alliance and management system, and making full use of the advantages of e-commerce enterprises in network big data. It is a new type of highly-efficient information system.

1.4 Research objectives

The methods of system science, investigation and analysis, analog simulation, system modelling, standardization system and others are employed in this research. What's more, collaborative theory is introduced to help solve from the perspective of system engineering the relevant issues in the construction of a logistics network consisting of the following typical activities: logistics network design, node simulation planning, drop-and-pull transport, logistics equipment standardization, information platform construction and so on.

1.4.1 E-commerce collaboration for better construction of logistics system

The logistics network construction in the era of e-commerce should lay more emphasis on collaborative management. Only in this way can the development of e-commerce be promoted and the efficiency of supply chain improved. (Colfer et al., 2005; Kong, 2012; Pan, 2016).

1.4.2 The construction of the whole logistics system

The thesis proposes the construction of logistics transportation network based on a four-stage radial-spoke logistics network to solve the problems of scattered transport items, difficult short-term aggregate transport task and hard product quality supervision in the process of logistics transportation. This network mainly includes: logistics hub centres (for line haul transit transport), logistics regional distribution centres (for further sorting and processing), e-commerce physical stores (urban distribution centres, and convenient for transit), and e-commerce rural cooperatives (the terminal of the goods delivery and the starting point of the goods collection). Getting through the “first mile” and “last mile” delivery, it provides one-stop transportation and distribution services in China so that e-commerce will expand across the country, thus laying a solid foundation for further expansion of e-commerce in the future.

1.4.3 Design of standard LCL box and application of drop-and-pull transport

According to the layout of logistics network and the design of standard LCL box, drop-and-pull transport is applied to line haul and terminal distribution so that the costs of logistics operation can be saved, logistics procedures can be simplified, and logistics efficiency improved (Qi, 2013).

1.4.4 Improvement of logistics efficiency

The ultimate goal of the thesis is to better apply the e-commerce collaborative theory to the logistics system. Therefore, reducing logistics costs and improving logistics efficiency are the key points. Through the system theory and the construction of the cloud platform, the ultimate goal of improving logistics efficiency and reducing logistics costs can be achieved.

Defining the concept of e-commerce collaborative management is of great importance. The application of the collaborative management framework enables the e-commerce collaborative management model to be promoted widely. A systematic framework should be built and the collaborative theory be promoted in all e-commerce enterprises. So the theory can be better applied in the construction of e-commerce logistics systems, which greatly improves collaborative efficiency between logistics system and e-commerce.

1.5 Introduction to Research Methods

1.5.1 Research methods

For the complexity of the research problems and research objectives, the research on the construction of e-commerce logistics system under collaborative theory should be scientific and systematic. Therefore six methods are proposed to solve the typical problems in the construction of logistics system.

1.5.1.1 Document analysis method

By consulting a large amount of data and analysing domestic and foreign research literatures about the theory of e-commerce collaboration and e-commerce collaborative logistics, the status quo of e-commerce collaborative theory can be understood comprehensively and correctly, which will be useful to analyse problems, find out the key points, and have an overall view of the issue (Bowen, 2013; Baxtar et al.,2016).

1.5.1.2 Comparative analysis method

The containers are divided into four classes by making a comparative analysis about the efficiency of containers so as to improve transportation efficiency. Cloud platform is transformed to establish a new big data platform (Fram, 2013).

1.5.1.3 Observation method (Destouni et al., 1997) (Asano et al., 2013)

This method is to seek inspirations through observation and research on former logistics platforms. According to the characteristics of e-commerce, the e-commerce logistics system is established to promote the development of e-commerce collaborative theory.

1.5.1.4 Simulation method

Using the simulation software like Autoload pro, the volume utilization ratio and weight loss of standard LCL loading in four design schemes are respectively calculated and the transportation strategy is given (Wu et al., 2003).

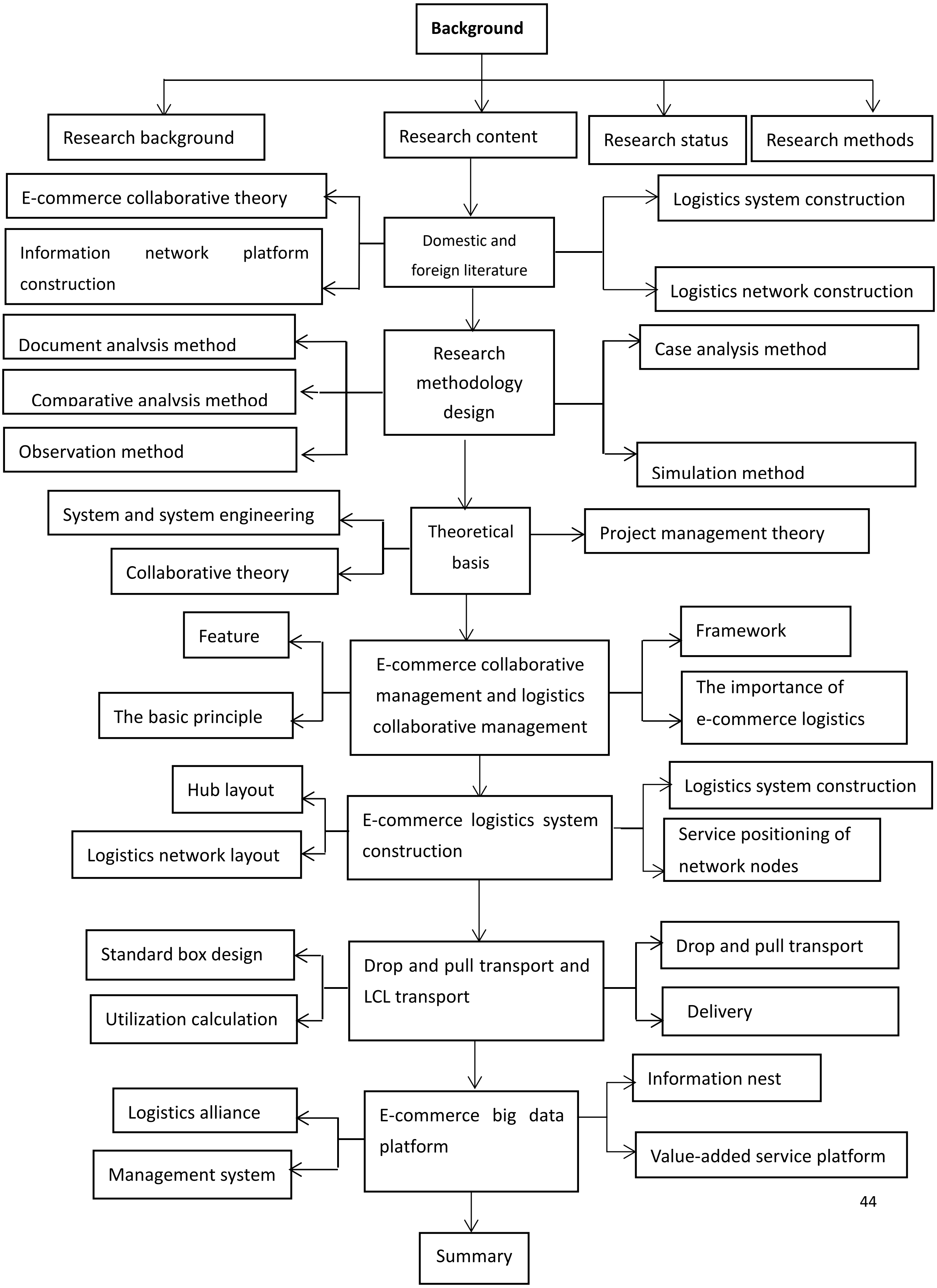
1.5.1.5 DSM method

The DSM matrix is to express the collaborative relationships among elements of the e-commerce collaborative management framework including information platform, e-commerce regional distribution centers, e-commerce hub, chain stores and convenience stores, and then the logistics system is constructed based on it.

1.5.2 Research Roadmap

This part mainly introduces the overall thinking of the research and describes the structure of the thesis in the form of a flow chart, so that the research will be shown clearly and logically.

Figure 1.3 Research Roadmap



1.6 Structure of the Research

The section above introduces the research roadmap and shows the structure of the research thesis. This section will describe the structure of the thesis in accordance with the technical roadmap so as to introduce in detail the research content covered in each chapter.

This research thesis is divided into nine chapters:

Chapter one: Introduction. The introduction part elaborates on the research background and significance of the establishment of an e-commerce logistics system under the collaborative theory and the classification of e-commerce. It focuses on the development status and development trend of B2C e-commerce and puts forward the research content, methods and research roadmap of the thesis.

Chapter two: This chapter comprehensively analyses appropriately the literatures both at home in China and abroad, which elaborates the current situation of logistics systems and logistics supporting e-commerce under collaborative management.

Chapter three: Research methodology design. This chapter describes the specific application of six research methods in the design of e-commerce logistics system from the perspective of collaborative management.

Chapter four: The concept of collaborative management of e-commerce projects is defined by employing collaborative theory, system theory and theory of system engineering, theory of project management, cumulative theory of project management, and mathematical quantitative methods.

Chapters five: With the conceptual model of collaborative management of e-commerce established, these two parts put forward the following ideas: the systematic conception of project collaborative management; the management mode and content of collaborative operation with collaborative logistics at its core; and the systematic approach of project collaborative management.

Chapters six and seven: Using specific ways and methods of system science, investigation and analysis, simulation, system modelling and standardization system, these two chapters aim to address from the perspective of systems, the relevant problems in the construction or development of a logistics network, that is, logistics network design, node simulation planning, drop-and-pull transport processes, logistics equipment standardization, information platform construction, and so on.

Chapter eight: This part focuses on improving the warehousing information management system of each node, establishing a vehicle dispatching system for the whole cloud platform, setting up a standard box monitoring system for the standardized LCL box, and unifying and connecting the management systems of all nodes so as to realize information sharing.

Chapter nine: this chapter makes a summary about the research contributions, limitations and recommendation for future research.

Chapter 2:

Literature Review

The first chapter elaborated on the research background and significance, research content, research objectives and research methods of this thesis, and analyzed to some extent the development status and development trend of e-commerce and e-commerce logistics. It emphasized that the researches on e-commerce logistics collaborative theory and e-commerce collaborative theory have played an important role in bridging the gaps in e-commerce in terms of time and space, providing possible solutions to the better performance of the first and last mile of delivery, and realizing real-time interaction of both logistics and information. Based on the background analysis, it proposed the construction of a logistics system for e-commerce under collaborative theory. Through collaborative management, drop-and-pull transport and LCL transport and the establishment of cloud platform, the e-commerce collaborative theory was fundamentally applied to the logistics system to achieve the goal of reducing logistics costs and improving logistics efficiency. This chapter will more comprehensively analyze the literatures at home and abroad according to the research content of this thesis. Then it will elaborate the current situation of logistics systems and logistics supporting e-commerce under collaborative management. The literatures includes research finding related to e-commerce collaborative theory, the construction of e-commerce logistics system, the construction of an e-commerce information network platform, and the construction of e-commerce network. Furthermore, this chapter will analyze the close relationship between the current e-commerce logistics system and the coordinated development of e-commerce. The important role of the information system platform in enterprise operation management, improving logistics efficiency and e-commerce satisfaction will be stressed. Through the analysis of the coordination between e-commerce and logistics, the transformation of e-commerce and logistics industry will be promoted, and the efficiency of e-commerce development will be improved so as to enhance the core competitiveness of the whole supply chain.

2.1 Related Research on E-commerce Collaborative Theory

In recent years, the e-commerce and logistics industry has seen good development trends. With the development and popularization of the theory of collaborative management, more and more scholars from both China and abroad have gradually paid attention to the research on the collaborative management of e-commerce and logistics and e-commerce and logistics collaborative theory thus emerges (Liu et al., 2014; Wu et al., 2016). Moreover, the future research on e-commerce in China may focus on collaborative management of e-commerce and the proportion of these researches may rise in the future. E-commerce collaborative management can be considered based on the purpose of the current research as the collaborative management of the supply chain. As for e-commerce, its cooperation with logistics enterprises should be strengthened, communication of supply chains reinforced and the value chain enhanced.

German physicist Hake (1977) systematically proposed the collaborative theory in 1977 which is concerned with the transformation of different systems from an unordered state to an orderly and stable state. Collaborative theory is concerning a series of subsystems which are trying to coordinate with each other to form certain rules. From the point of view of collaborative theory, the stability and order of a large system or a complete network are the results of the interaction and coordination among its huge number of subsystems. It is considered that the issue of e-commerce logistics is actually an issue very relevant to the supply chain. Through the collaboration of the supply chain, the main line of e-commerce logistics is connected.

American enterprise Wal-Mart (1995) put forward the CPFR strategy or collaborative planning forecasting and replenishment strategy and put it into practice. Then large companies followed suit one after another. However, similar research in China is still at the initial stage. So it is necessary to accelerate research in this field to give guidance to enterprises so that they can improve collaborative management, enhance their competitiveness, and adapt to the competition in the future.

Anderson (1999) put forward the new supply chain strategies focus on the collaborative supply chain, which will become the mainstream in the future. Supply chain collaboration refers to a networked association formed by two or more enterprises through company agreement or joint organization in order to achieve certain strategic purposes. It seeks the intermediate organizational effect and pursues the value chain advantage so as to construct competitive advantage groups and maintain the competitiveness of core culture. In this era of “Internet plus”, the integration of e-commerce and logistics has become a trend, and based on the supply chain collaborative theory, the theory of e-commerce collaborative logistics has come into being.

Lin Canhong (2012) published “A web-based intelligent collaborative logistics management decision support system for enhancing the cost effectiveness of door-to-door delivery” which combined the intelligent collaboration with the logistics management decision-making system to lower terminal distribution costs .

Zeng Wentao (2005) elaborated on the concepts of collaboration and self-organization and on the collaborative theory. Then he discussed the definition and characteristics of collaborative logistics management and proposed that the implementation of collaborative management should be based on the operational mechanism of "competition-cooperation-coordination".

Du Jiangping (2002) put forward the three stages of collaborative e-commerce implementation: the phase of the construction of network hardware and basic office systems, the phase of the improvement of office systems and the construction of business functional management and then the phase of the establishment of e-commerce system to achieve enterprise operation and management.

Liu Shenghua (2005) defined a supply chain collaborative theory based on e-commerce.

Turkay (2004) also made an empirical study of chemical engineering in a collaborative supply chain.

Li Ling (2004) analysed the concept of project collaborative management and the internal synergetic relationship and effect, studied the synergetic rules and characteristics of a collaborative management system in e-commerce project and then established collaborative management frameworks, mechanisms, and computer-supported collaborative work platforms. In the end, an independent collaborative management mechanism for e-commerce projects was founded.

Bergamaschl, S (2006) proposed the data integration method of project management in a virtual enterprise in “An Intelligent Data Integration Approach for Collaborative Project Management in Virtual Enterprises”.

Bai Liehu (2007) raised the possibility and necessity of introducing collaborative theory into management research. The collaborative management theory, as he considered, was the basic idea and method of using the collaborative theory to manage according to the collaborative laws of the management objects. The main goal of the collaborative management was to realize the collaborative effect, which refers to the “2+2>4” effect. Essentially, it is the interaction, coordination and synchronization of the collaborative factors in a certain way and the order parameter of which dominant system development is acquired. With help of the order parameter, an orderly and stable development of system may be achieved and the whole function of the system can be enhanced or multiplied.

Xia Lu (2007) set out from three types of enterprise value chain strategies: horizontal integration, vertical integration and strategic alliance, and then proposed that enterprises must strengthen collaboration and cooperation in the e-commerce environment.

Sheng Ge (2007) based on the trend of flexible management, tried to coordinate and adjust the relations between information platform and enterprises from the perspective of dynamic integration and then built an e-commerce collaboration platform, promoting the development of e-commerce.

Wu Yu (2016) gave suggestions to help realize the collaborative development of e-commerce and logistics industries from three aspects of national macro-control, enterprise development strategy, and business operations.

Wang Ling (2016) studied the resource integration path of e-commerce joint distribution based on collaborative theory and proposed that the application of joint distribution mode in e-commerce can optimize delivery volume, reduce the waste of logistics resources and delivery costs, improve the logistics services, and promote the efficient circulation of goods throughout the society.

Wu Baohong (2011) put forward the connotation of collaboration of steel logistics with e-commerce system, and demonstrated that the goal of such collaboration is to achieve information sharing, high efficiency and low costs in steel logistics.

The new trend of e-commerce collaborative development inevitably makes new requirements for logistics. The above scholars have already shown the close relationship between them. There are also scholars who analysed how e-commerce and logistics worked together (Wang et al., 2015; Lu et al., 2016).

2.2 Related research on the construction of an e-commerce logistics system

The development of e-commerce collaboration should give priority to the coordination of the logistics system and e-commerce. However, the current domestic logistics system and e-commerce in China have not yet realized coordinated development. Logistics, as the pillar of e-commerce, should have developed in line with the development of e-commerce, but the poor logistics system construction and connection in China now limit e-commerce development to a large extent. Scholars at home in China and abroad (Yang Yun(2005) 、Jesse W. J. Weltevreden(2008)、Chen Ying(2010)) tried to combine the characteristics of logistics and e-commerce to make a plan for logistics and resource allocation. As the core of B2C e-commerce, the development of logistics distribution is now restricted by the following factors: poor connection between e-commerce enterprises and logistics enterprises, bad terminal distribution service, and poor logistics environment. Therefore, the key of the current logistics system construction is to improve the efficiency of logistics distribution and to effectively overcome the difficulties in the “last mile” delivery with personalized services.

Yang Yun (2005) combining the characteristics of logistics and e-commerce, discussed the close relationship between e-commerce collaborative logistics and the development of e-commerce, and then presented the construction of a collaborative logistics system based on the e-commerce environment.

According to Jesse W. J. Weltevreden (2008), freight transport enterprises and logistics enterprises will be affected under the e-commerce mode. For different products with different liquidity, the logistics form adopted was also different. In addition, requirements were made on the personalized distribution of e-commerce logistics.

Chen Ying (2010) believed that e-commerce had so much potential that it can break the bonds preventing the development of the logistics enterprises, and the improvement of logistics could promote the development of e-commerce.

Lin Xiaorui (2011) put forward that customer satisfaction could affect purchase intention. Both the development of e-commerce and the development of logistics, therefore, should try to improve customer satisfaction. All in all, it is a must to solve the problems existing in the last-mile delivery service.

Duan Yujun (2014) analysed the existing e-commerce logistics system and tried to introduce collaborative theory into logistics to overcome the bottleneck of e-commerce development.

Yang Juping (2014) published a thesis on Business Economics and Management Journal arguing that China has seen rapid development in B2C e-commerce and the proportion of e-commerce transactions was also increasing, but it was very difficult to achieve high-quality "last mile" delivery. In addition, the compression of the B2C e-commerce supply chain also makes the e-commerce logistics problems occur almost in the "last mile" delivery. It could be said that "the last mile" delivery was the core of B2C e-commerce.

Li Zhuoya (2014) pointed out that with the explosive development of B2C e-commerce in China, the terminal logistics delivery system of the e-commerce increasingly showed signs of failing to satisfy market demand. In addition, there were still many problems existing, such as poor connection between e-commerce companies and logistics companies, poor terminal delivery service and restrictions from logistics environment.

Zhang Haipeng (2017) also held that sustainable development of e-commerce will be realized if logistics efficiency can be raised by unified deployment.

Song Jian (2018) furthermore proposed that B2C e-commerce enterprises have two choices in terms of logistics management. One is to build a logistics networks on their own to make delivery and manage logistics by themselves. The other is to cooperate with third-party logistics enterprises to carry out logistics delivery. Then he analysed respectively the problems of each choices and gave suggestions: the development of B2C e-commerce enterprises should be based on actual situations, that is, the financial condition and state of operation of the enterprises, and how much they know about logistics distribution. All in all, the e-commerce enterprises should be down to earth and choose the suitable logistics distribution mode.

In view of the characteristics of logistics and e-commerce, scholars at home and abroad presented the construction of a collaborative logistics system based on the e-commerce environment, took B2C e-commerce to make an analysis about the existing e-commerce logistics system, and tried to introduce collaborative theory into logistics to overcome the bottleneck of e-commerce development.

2.3 Related researches on the construction of e-commerce information network platform

For the coordinated development of e-commerce, in addition to constructing the supporting logistics system, the construction of an information network platform is of equal importance (Liu, 2014; Xue et al., 2016). The information management system of e-commerce will also affect the development of the whole e-commerce business. Therefore, in order to build a high-efficiency, high-quality, and low-cost e-commerce platform, it is necessary to build a collaborative logistics information platform. At the same time, if an enterprise is aimed to make long-term online transactions in the highly competitive e-commerce environment, it inevitably embarks on the road to provide value-added services. The diversification of users' needs urges companies to develop diversified products, which mainly refers to more detailed classification of products to meet the demands in different businesses.

Elliot Rabinovich (2004) for example demonstrated through the theory of strategic networks that a wide logistics network is necessary for e-commerce enterprises to cooperate with supply companies.

Wang Yu (2006) also emphasized the establishment of the collaborative e-commerce platform, by analysing the information flow of e-commerce enterprises under the circumstance of collaborative e-commerce, and presented a plan for the e-commerce logistics.

Dong Xiangjun (2010) furthermore held that logistics as a main form to facilitate the completion of e-commerce transactions must adapt to the development of e-commerce. The construction of collaborative logistics information platform for e-commerce enterprises could fully reflect the true characteristics of e-commerce and achieve its goal of high efficiency, high quality and low cost.

Ding Guoying (2010) studied the construction of agricultural products e-commerce platform and information network, and proposed that the construction of an information network can promote the improvement of agricultural products e-commerce platform and agricultural products circulation system, which is of great significance to agricultural security, stability, high efficiency and modernization.

Li Xiuli (2011) in the same vein asserted that the combination of e-commerce and logistics in which logistics enterprises, e-commerce enterprises and information technology enterprises are all involved, would help to provide better service for customers.

Luo Juanjuan and Xu Zhongsheng (2012) proposed a new service model for logistics companies--e-commerce third party operations, which presented a new way to make profits.

Xu Zhongyan (2014) additionally advocated that the big data platform of e-commerce could capture the real needs of customers and transform them into figures to spread in the supply chain and then logistics and resource allocation are planned.

Zhao Xing (2015) put forward that in order to create long-term online transaction platform with increasingly diversified user demand and gradually mature market environment, it is inevitable to provide value-added services, more specifically, to establish a multi-functional, advanced and practical e-commerce value-added service system. However few e-commerce platform operators now try to develop value-added services. How to upgrade the supply and value chains with the help of e-commerce platform based on value-added services has therefore become an urgent problem to be addressed.

Pan Zhu (2016) contributed to this effort by constructing a collaborative management model of e-commerce and logistics in the big data era and put forward that only the collaboration of e-commerce and logistics enterprises, especially on the big data information platform, could promote the transformation of e-commerce and logistics industry and enhance the core competitiveness of the whole supply chain.

Duan Shenghao (2018) proposed that in the development of e-commerce, there exist problems such as information asymmetry which means that under market conditions, to achieve fair trade, the information mastered by both parties must be symmetrical. Price wars between customers and logistics enterprises and the large-scale price wars between logistics enterprises where enterprises take lower price as their major competitiveness in the logistics market, have affected the normal order and service quality of the logistics industry. What's worse, these problems also reduced the profits of logistics enterprises. In this context, the author suggested to establish a comprehensive platform for sharing logistics resources where all orders are sent to the platform according to the requirements of customers and logistics enterprises reasonably receive orders, which, to some extent, could save social resources, improve logistics efficiency, and ensure the timeliness of logistics.

In the development of e-commerce, the problem of information asymmetry between customers and logistics enterprises has affected the normal order and service quality of the logistics industry. The information flow of e-commerce enterprises is of great importance, so they emphasize the establishment of the collaborative e-commerce platform by analysing the information flow under the circumstance of collaborative e-commerce, and make a plan of the e-commerce logistics. Only the collaboration of e-commerce and logistics enterprises, especially on the big data information platform can promote the transformation of of e-commerce and logistics industry and enhance the core competitiveness of the whole supply chain.

Wu Bo (2017) analyzed the development trend of and problems in the collaboration of foundry industry logistics with information flow in the e-commerce environment. He proposed strategies to improve the quality of collaboration of foundry industry logistics with information flow from three aspects: promoting the development of informationized and networked logistics, constructing a scientific logistics information system, and establishing a supporting system for the development of logistics and information flow.

Zhao Yuxin (2019) analyzed the importance of developing rural e-commerce information platform, put forward the problems and shortcomings of the construction of e-commerce information platform in rural China, and explored the path of constructing rural e-commerce information platform in the background of "Internet plus".

2.4 Related researches on the construction of e-commerce network

Currently, a great deal of domestic and foreign researches on the B2C e-commerce logistics are carried out based on both empirical and theoretical study (Han,2013; Wen,2016). However, there is generally still no systematic answer to the question that what kind of method enterprises should adopt for logistics distribution. From the perspective of perfecting the logistics network to improve the efficiency of logistics distribution and in view of the urban-rural integration process, a radial logistics network can be built to improve the efficiency of logistics between towns and villages.

An expert named Kent N. Gourdin (2001) pointed out that one important index for customers to judge B2C e-commerce satisfaction was logistics distribution. Besides, he proposed a quality evaluation model of B2C e-commerce logistics service. The evaluation model consists of two major indexes, namely, customers and businesses. Based on the analysis of the relationship between customers and businesses, he elaborated the reasons of customers' complaints about the quality of B2C e-commerce logistics service and concluded that logistics distribution played an extremely important role in B2C e-commerce activities.

American experts Haul Lee and Scungin Whang (2001) pointed out that logistics was an important aspect of B2C e-commerce. At the same time, logistics was still the last link of business-to-customer online transactions, for the completion of delivery signifies the completion of a B2C e-commerce transaction.

Japanese logistics scholar Yukao Asao (2002) pointed out in the book *IT Logistics* that B2C e-commerce greatly expanded the connotation of logistics distribution.

Liu Chanyuan (2005) pointed out that e-commerce has advantages of convenience and quickness, and these advantages cannot be bought out without supportive logistics distribution. Backward logistics distribution will limit the development of B2C e-commerce. B2C calls for technology-based, intelligent and flexible logistics. Enterprises' self-built logistics and cooperation with third-party logistics enterprises are logistics models that are now suitable for B2C e-commerce enterprises

Li Jianjun (2013) asserted that the collaborative development of regional logistics depended on the construction or development of corresponding collaborative mechanisms and the regional logistics should realize collaborative development through the fixed effects of endogenous and exogenous coordination mechanisms. The endogenous coordination mechanism refers to the mechanism that generates spontaneous motivation due to the needs of survival and development of the organization itself. The exogenous coordination mechanism includes the design of the external environment coordination mechanism, the design of the industry development coordination mechanism, and the technical coordination mechanism so as to ensure the normal operation of the industry ecosystem. Regional logistics collaboration is closely related to regional logistics development. The former promotes the latter, while the latter is the basis and precondition of the former.

Li Fengyan (2014), based on the structure and features of a radial-spoke grain logistics network, proposed a conceptual collaborative framework for a radial-spoke grain logistics network in China, that is, taking network optimization as driving force, competition and cooperation as the path to collaboration, and high efficiency, smoothness as well as economy as the objectives of collaboration, thus promoting the establishment of grain logistics network in China. The strategies employed were mainly including competition between logistics network nodes, sharing of logistics media and network resources and common management of logistics.

Zhao Shukuan and Zhang Dawei (2015) proposed the concept of building a rural logistics network, and they both elaborated on the six components of the rural logistics service network project. Then they took corresponding safeguard measures for the construction of the rural logistics service network and provided guidance for the development of urban and rural logistics. They suggested to make up for the deficiencies of the rural logistics network and share the existing logistics sites and resources reserve on the logistics network so as to adapt to the current distribution density in rural areas.

Tao Juncheng, Pan Lin and Chu Yeping (2016) pointed out that it was of great significance to correctly understand the role of urban and rural logistics networks as new economic carrier in breaking the urban-rural dual structure in China, realizing the integration of urban and rural development and promoting the inclusive growth of urban and rural areas. Afterwards, they proposed the principles and ideas for the development of urban and rural logistics networks.

They suggested that big data sharing should be applied to the establishment of a county-town-village three-level logistics network. The logistics distribution centres and sites in towns and villages should be selected based on new economic flow. They advocated the optimization of logistics networks and the realization of information sharing on platforms and integration of resource channels. In addition, they suggested to make up for the deficiencies of the rural logistics network and share the existing logistics sites and resources reserve on the logistics network so as to adapt to the current distribution density in rural areas. Finally, the relatively influential market players should take the lead in constructing the urban and rural logistics network and then coordinate the logistics needs of different channels to reduce supply costs.

Xu Yinwen (2018) studied the collaboration of logistics distribution network in the e-commerce environment, and proposed that the collaboration of logistics distribution network and the planning of vehicles contacting nodes are imperative problems to be solved by e-commerce enterprises. Based on the space-and-time-based network collaboration, she established an optimized model of mixed-vehicles distribution path with the goal of minimizing logistics costs.

Liu Shuo (2019) proposed the construction of a logistics network based on the three-stage logistics nodes in counties, towns and villages respectively, and put forward that optimizing and integrating various rural logistics resources will help to lower costs and boost efficiency, and further achieve the optimization and integration of logistics distribution network.

Logistics is an important aspect of B2C e-commerce, and in turn B2C e-commerce has greatly expanded the connotation of logistics and distribution. Enterprises' self-built logistics and cooperation with third-party logistics enterprises are logistics models that are now suitable for B2C e-commerce enterprises. Regional logistics collaboration is closely related to regional logistics growth. The former promotes the latter, while the latter is the basis and precondition of the former. Besides, it is of great significance to correctly understand the role of urban and rural logistics networks as new economic carrier in breaking the urban-rural dual structure in China, realizing the integration of urban and rural development and promoting the inclusive growth of urban and rural areas.

2.5 Summary

This chapter analyzed the scholars' researches both in China and other countries on e-commerce and logistics. These researches are related to e-commerce collaborative theory, the construction of e-commerce logistics system, the construction of e-commerce information network platform, the construction of e-commerce network. This thesis will unfold on the basis of these theories.

It can be seen from the research status of e-commerce and logistics systems by scholars at home and abroad that there are still some limitations and gaps in the research in this field. The research on collaborative theory started earlier and with the development of e-commerce, e-commerce collaborative logistics theory has gradually become the focus of scholars. However, the collaborative theory research on logistics and e-commerce is mainly on the macro level, focusing on the interdependence and interaction between the two parties. The development of E-commerce poses a challenge to the logistics system, and at the same time it stimulates the rapid development of the logistics industry and promotes the continuous improvement of the logistics network, while as the key for e-commerce to maintain competitiveness, the stable development of logistics has laid a foundation for the expansion of e-commerce enterprises. Some scholars who analyze how e-commerce and logistics achieve collaboration from the perspective of collaborative management, combine the characteristics of logistics with e-commerce and propose relevant countermeasures for supply chain collaborative logistics management and logistics system construction based on the e-commerce environment. With regard to the research on e-commerce information network platform, most scholars focused on the important role of information flow in e-commerce collaborative management, and verified that big data platform is the key factor for e-commerce enterprises to enhance their core competitiveness. However, relevant research on how to collaborate information platform with e-commerce and e-commerce logistics is far from enough. For the research on the construction of e-commerce logistics network, scholars provided relevant optimization measures for improving the logistics network by combining practice and theory. In order to improve the efficiency of logistics distribution, the radial-spoke logistics network was proposed, but few research explored in-depth the network construction. In other words, there is still no systematic answer to the question which logistics network distribution mode the enterprises should adopt. Generally speaking, the current research on e-commerce logistics system is relatively scattered and unsystematic and do not explore the systematic planning for collaborative management of e-commerce, e-commerce logistics and information platform, so the effect of improvement of logistics efficiency are not obvious. Therefore, from the perspective of system, the thesis will extend the collaborative theory to e-commerce enterprises and design e-commerce collaborative management framework to realize collaborative management of e-commerce, e-commerce logistics and information platform. It will help to construct a logistics system, improve the logistics network, optimize facilities and equipment, and finally integrate e-commerce and internal management platform based on the construction of collaborative logistics system, thus transforming information platform, improving logistics efficiency, and promoting e-commerce collaborative theory.

The next chapter will discuss the focus of this thesis based on the research results of scholars at home and abroad. Through the design of six research methods, the framework design of e-commerce collaborative management and e-commerce logistics collaborative management will be completed, and the e-commerce logistics system will be constructed from the perspective of collaborative theory.

Chapter 3:

Research methodology

Through the above analysis and discussion of the research status in China and abroad, the collaborative theory, the theory of project management, and the construction of logistics system with the help of relevant concepts of system engineering have been introduced in chapter 2. It is also necessary to improve the information system, develop an e-commerce network big data platform in order to ensure information flow and improve operational efficiency. This chapter will describe research methods employed in this thesis in more detail, and introduce the selection and application process of the six research methods considered: document analysis method, observation method, comparative analysis method, simulation and DSM method. This chapter will discuss both the theoretical basis and the construction of e-commerce logistics system with the help of DSM matrix from the perspective of collaborative management. A variety of research methods including both qualitative and quantitative methods and DSM matrix will be employed to help solve from the perspective of system engineering the relevant issues in the construction of logistics network: logistics network design, node simulation planning, drop-and-pull transport processes, logistics equipment standardization, information platform construction and so on. This is done to ensure that the research is more feasible, systematic, and scientific.

3.1 Research methods selection

In view of the complexity and systematic nature of this research it employs a variety of research methods including both qualitative and quantitative methods.

Firstly, literature survey is used to help to understand and analyze the research status in China and abroad, so as to provide an important theoretical basis for the issues of this research such as collaborative management of e-commerce projects, collaborative management of e-commerce logistics, the construction of a logistics system or network, and the construction of information platforms. Furthermore, this thesis proposes a framework design of e-commerce collaborative management and e-commerce logistics collaborative management. Secondly, the observation method is employed to study the existing e-commerce logistics platform.

Then it puts forward the design of a logistics system or logistics network, or to be specific, a four-stage radial-spoke logistics networks containing e-commerce hubs, e-commerce regional distribution centres, e-commerce physical stores, and e-commerce cooperatives.

Thirdly, the comparative analysis method and simulation method are employed to work out design schemes for standard LCL (Less than Container Load) boxes, that is, based on 40-foot standard containers (Liu et al., 2017; Zheng, 2017), four series of new containers are designed to complete Less than Container Load cargo loading and schemes of transportation test as well as innovation and improvement of the big data platform. The main reason that this research employed a variety of research methods is to achieve the research objectives stated in chapter 1 with the help of collaborative theory and help to address from the systematic perspective the issues related to the construction of a logistics network, that is, logistics network design, node simulation planning, drop-and-pull transport process, logistics equipment standardization, information platform construction, and so on. This will also be helpful to improve the validity and reliability of the research and make it more instructive in reality. The next section introduces the research methodology design in more detail.

3.2 Research methodology design

3.2.1 Literature survey

Only standing on the shoulders of giants can people see farther and that is true for literature survey. Through the summarization and refinement of the research results of scholars in China and abroad, the contribution and limitations of the existing researches are found, which provides the basis and support for the subsequent research (Bowen et al., 2013, Liu et al., 2013; Mei et al., 2014).

Reviewing relevant literatures, the research findings both in China and other countries are analysed from the perspectives of e-commerce collaborative theory, the construction of e-commerce logistics system, the construction of an e-commerce information platform, and e-commerce network. This provides an important theoretical basis for collaborative management of e-commerce, collaborative management of e-commerce logistics, construction of the logistics system or logistics network, and construction of the information platform. What's more, according to the collaborative theory, the project management theory and relevant concepts of system engineering, the framework design of e-commerce collaborative management and e-commerce logistics collaborative management is proposed.

3.2.2 Observation method design

The observation method refers to a method in which researchers use their own senses and auxiliary tools to directly observe the object to be studied and based on certain research outlines or observation tables（Destouni et al., 1997; Phythian et al.,2012).

This method is employed to observe and study the operation modes, current status and system construction of the existing e-commerce logistics platform. It will take all the relevant factors such as the customers' and enterprises' demands, the characteristics of e-commerce logistics into account to give solutions to the improvements of the construction of an e-commerce logistics system and the innovation of the existing logistics model. Based on the actual situation of each enterprise, a four-stage radial-spoke logistics network (containing e-commerce hubs, e-commerce regional distribution centres, e-commerce physical stores, and e-commerce cooperatives) is designed to connect all parties involved in the supply chain. With the help of collaboration, all logistics nodes can innovate logistics mode and implement collaborative distribution, so as to integrate resources, reduce costs, and improve logistics efficiency. Moreover, the new-standard LCL boxes that are divided into three classes are designed for drop-and-pull transport (Gregor et al.,2013; Wierenga et al.,1998; Vaishnavi,2015). Drawing on the DSR approach, the thesis considers the influencing factors of many aspects, such as the carrying capacity of vehicles in line haul transport, the empty weights of the first-stage standard box, the second-stage large standard box, the second-stage small standard box and the third-stage standard box, and the specifications of the 13 kinds of logistics packing boxes and the 15 kinds of woven mesh bags, to reasonably implement drop-and-pull transport and LCL transport， thus Improving logistics efficiency and addressing current problems in terminal logistics delivery in China (Geerts, 2011).

3.2.3 Comparative analysis method and Simulation method design

The Comparative analysis method is to compare objective entities by adopting appropriate comparison criteria and data indicators to make correct judgments on the essence and laws, and finally draw conclusions and achieve a research objective (Fram, 2013). Simulation is to use virtual reality technology which needs to use computer to create and experience unreal worlds to achieve virtual reality effects through simulation software (Wu et al., 2003; Burdea et al., 2015).

The comparative analysis method is mainly used in this thesis in the design schemes of standard LCL boxes. Four series of standard LCL boxes are designed based on the design concept of 40-foot standard containers. The four types of containers are first-stage standard boxes, second-stage large standard boxes, Second-stage small standard boxes, and third-stage standard boxes.

In the four design schemes of standard LCL boxes (Zhang et al., 2012), the standard LCL boxes of the same type are consistent in length and width but different in height. The length and width of the first-stage standard LCL boxes should be suitable for line haul and feeder transportation and terminal delivery for large customers. That is, it can be transported both by a 12-meter semi-trailer and a city distribution vehicle. Based on the size of a 12-meter semi-trailer and the city distribution vehicles, through calculation, the length and width of the first-stage standard LCL boxes are 2.4 meters and 2 meters respectively, and the height is 2.6 and 2.4 meters. The second-stage standard LCL boxes are for the delivery for small customers in urban distribution. Besides, their length and width are designed in line with the requirements of mixed-loading of first-stage and second-stage standard boxes. So there is an integer proportional relationship between the size of first-stage standard boxes and that of the second-stage standard LCL boxes. Therefore, the length and width of the second-stage large standard LCL boxes are 2 meters and 1.2 meters respectively, and the height is 2.6 meters and 2.4 meters; the length and width of the second-stage small standard LCL boxes are 1.2 meters and 1 meter respectively, and the height is 2.6 meters, 1.3 meters, 1.2 meters, and 2.4 meters；Therefore，the dimensions of first-stage standard box including length 、 width and height is twice that of second-stage small standard box).

The third-stage standard box is used for terminal delivery for small customers. Due to its distribution characteristics, the crowdsourcing logistics mode and mini-vehicles will be used for distribution. The loading capacity rate of the mini-vehicles carrying the third-stage standard boxes is calculated. With the help of DSR method, the commonly used mini autos are selected and their official indicators are obtained through literature review. Therefore, the third-stage standard LCL boxes are used for the terminal delivery for individual customers. The length and width of it are 0.6 meters and 0.4 meters respectively, and the height is 0.87 meters and 0.8 meters. In this way, four series of standard LCL boxes are designed as a result, as is shown in Table 3.1.

Table 3.1 Four design schemes for standard LCL boxes

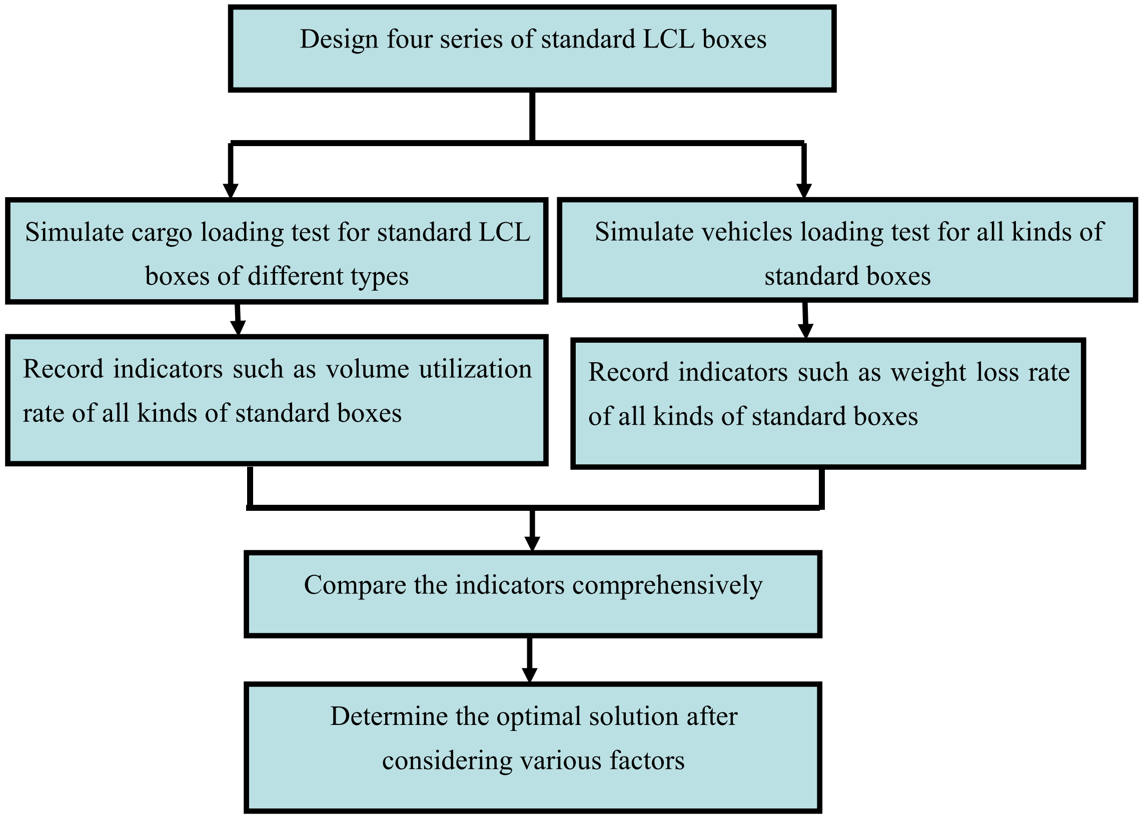
	First-stage standard box	Second-stage large standard box	Second-stage small standard box	Third-stage standard box
Scheme one				
External dimensions (m)	2.4*2*2.6	2*1.2*2.6	1.2*1*2.6	0.6*0.4*0.87
Internal dimensions (m)	2.24*1.84*2.3	1.84*1.04*2.3	1.04*0.84*2.3	0.55*0.35*0.82
Scheme two				
External dimensions (m)	2.4*2*2.6	2*1.2*2.6	1.2*1*1.3	0.6*0.4*0.87
Internal dimensions (m)	2.24*1.84*2.3	1.84*1.04*2.3	1.04*0.84*1	0.55*0.35*0.82
Scheme three				
External dimensions (m)	2.4*2*2.4	2*1.2*2.4	1.2*1*1.2	0.6*0.4*0.8
Internal dimensions (m)	2.24*1.84*2.1	1.84*1.04*2.1	1.04*0.84*0.9	0.55*0.35*0.75
Scheme four				
External dimensions (m)	2.4*2*2.4	2*1.2*2.4	1.2*1*2.4	0.6*0.4*0.8
Internal dimensions (m)	2.24*1.84*2.1	1.84*1.04*2.1	1.04*0.84*2.1	0.55*0.35*0.75

Then, through a simulation method based on some software, such as Autoload pro、 3Dmax (Li et al., 2016; Zhou et al., 2019), the cargo loading test of the four types of standard boxes is carried out based on the 13 kinds of logistics packaging boxes and woven mesh bags of 13 specifications (Gao et al.,2017； Peng et al., 2018). Thus, the volume utilization ratio, load ratio and the types as well as quantity of the loaded goods are determined separately.

Then, according to the size and weight characteristics of each standard box, With the help of DSR method, the commonly used line haul and feeder transport vehicles are selected and their official indicators are obtained through literature review, and the loading plan of these transportation vehicles is determined separately. Among them，first-stage standard box、second-stage large standard box and second-stage small standard box are mainly used for line haul transportation, and the transportation vehicle is a low flat semi-trailer with a load of 30,000 kg; Third-stage standard box is mainly used for feeder transportation, and the transportation vehicle is mainly for micro-cars. This thesis takes Dongfeng Xiaokang K01 as an example. Transportation vehicles are to load each type of standard box can that be loaded with common cargos in simulation to determine the loading rate and weight loss rate. And through the obtained indicators, the rationality of the size design of standard LCL boxes is validated.

Finally, the volume utilization rate and weight loss rate of each type of standard boxes are compared with each other and ones with reasonable value are selected. Besides, considering the factors such as city distribution requirements, customer base and delivery cost, the standard LCL boxes scheme is finally determined. This Comparative analysis method and Simulation method design are shown in more detail in figure 3.1

Figure 3.1 Comparative analysis method and simulation method design



Furthermore, the comparative analysis method is also applied to the transformation and innovation of a big data platform in this research thesis. Based on the existing network platform and its shortcomings, the logistics alliance and the management system are combined together to create an integrated, comprehensive, convenient information system to achieve more efficient operation and smooth information flow. It may help to avoid the drawbacks of "information islands" (Olorunniwo et al., 2010), and realize the dual goal of guaranteeing both customer satisfaction and employee convenience, as well as create a more complete "e-commerce big data platform" (Cho et al., 2011).

3.3 Application of Design Structure Matrix (DSM)

Based on the collaborative theory, the research designs the e-commerce collaborative management framework, integrates the business process for the whole logistics process, builds a four-stage radial-spoke logistics system, and combines the collaborative theory with the cloud platform to take advantage of the e-commerce big data platform, so as to improve logistics efficiency. Therefore, this thesis chooses the DSM method to show the relationships among the five elements of information platform, e-commerce regional distribution center, e-commerce hubs, chain stores and convenience stores in the DSM matrix, more clearly displaying the e-commerce logistics system construction process.

3.3.1 Introduction to DSM

The Design Structure Matrix (DSM) was introduced by Steward in 1981. DSM a matrix-based technique to analyze information flow and reflects indirectly the information dependency among the variables in complex processes.

Design Structure Matrix (DSM) is an N^2 square matrix used to display and analyze the interactions of various elements in the matrix. It is a more intuitive and concise technique for visualized analysis of complex projects. In the binary N^2 matrix, the elements of the system are placed in the same order in the leftmost and topmost of the matrix. If there is a relationship between element i and element j, the cell in i row and j column in the matrix ($cell_{ij}$) will be marked (or represented by the figure 1); otherwise, it will be represented by a blank space (or by the figure 0). In the binary matrix (marked by figure 0 or 1), the diagonal cells are generally not used to describe the system.

In a DSM, the activities sequence is represented by consecutive non-zero cells below the leading diagonal and adjacent to the leading diagonal. The non-zero cells below the leading diagonal describe the logical relationship in the direction from the upstream to the downstream activities, that is, all activities of the entire process, which is the forward flow, while the non-zero elements above the leading diagonal describe the feedback of the downstream activities to the upstream activities, which is the feedback flow. Forward flow and feedback flow form a coupling. A row or column consisting of cells marked by 0 is called an end element.

3.3.2 The Application of DSM

The Design Structure Matrix (DSM) is used to indirectly show the information dependency among the variables in complex processes in the form of a matrix. The e-commerce collaborative management template studied in this thesis involves multiple interrelated factors such as information platform. Therefore, the DSM matrix is adopted to show the collaborative relationship of each element.

Based on collaborative theory, a four-stage radial-spoke network is designed to integrate logistics business processes and bridge the gap between the first-mile and last-mile delivery. Meanwhile, the collaborative theory and cloud platform are perfectly combined to give full play to the advantages of e-commerce big data, thus improving transportation efficiency.

The e-commerce collaborative management framework studied in this thesis mainly includes the elements of information platform, e-commerce regional distribution centers, e-commerce hub, chain stores and convenience stores. This section will show the collaborative relationships of all elements through the DSM. All the elements are denoted by English letters. To be specific, the information platform is denoted as a, the e-commerce regional distribution center as b, the e-commerce hub as c, the chain store as d, and the convenience store as e. The collaborative relationships among the elements are shown in the DSM in Table 3.2:

Table3.2 The collaborative relationships among the elements

	a	b	c	d	e
a	a	1	1	1	1
b	1	b	1	0	0
c	1	1	c	0	0
d	1	1	1	d	0
e	1	0	0	1	e

The DSM matrix application method means that "1" in the matrix represents a direct relationship between the elements in the corresponding row and column, and "0" represents that there is no direct relationship between the elements in that row and column. For example, the information platform "a" is associated with all elements while the convenience store "e" is only associated with the information platform "a" and the chain store "d".

In the e-commerce collaborative management framework, information flow comes into being with e-commerce activities, running through all links of supply chain. Therefore, the information platform is inextricably linked to other elements, including forward information and feedback information. Because of the precedence of the information flow, the goods delivery process is in sequence. Once the goods are collected by the source of the supply chain, that is, the terminal nodes, they are sent to the e-commerce regional distribution centers by vehicles dispatched by the vehicle dispatching platform. And after the goods are loaded in standard LCL boxes, they will be transported to the e-commerce hub by means of drop and pull transport, where they will be sorted, packed and transported to another e-commerce regional distribution centers according to customer orders. Then the e-commerce regional distribution centers will make the delivery for major customers such as the chain stores. As for goods of customers in villages and towns, they will be reloaded in the standard boxes in the centers and be transported through LCL to the terminal nodes. Finally, the terminal nodes will make the last-mile delivery. In order to improve the overall operational efficiency, drop and pull and standard LCL box transport are employed in the framework proposed in this thesis, and traditional information platform is transformed, thus removing the time and spatial barriers in the supply chain and realizing information sharing.

3.4 Application of Design Science Research (DSR)

3.4.1 Introduction to DSR

Most purposeful human activities comprise the steps of design and implementation. Design works out the path of implementation and determines the results of implementation. Therefore, design is the first step of all purposeful human activities. (Xie, 2017; Zhuang, 2012).

Design science involves the knowledge concerning design. It deals with all the purposeful activities of human beings and conforms to both the laws of nature and the laws of society (Chen et al., 2011; Rao et al., 2011; Wierenga et al., 2008). Design, as the object of design science, is regarded as a kind of scientific activity. Design science cannot be simply classified as a natural science or one of a humanities and social sciences, for it goes beyond the scope of the two and is not a synthesis of the existing subjects. Design science study seeks to meet people's demands for novelty, serve a better life of human beings and the progress of society by working out ways to solve problems. The object of design science study is design, which involves both "things" and "objects", as well as the designers and users. Design, that is to say, deals with a system of people-things-objects. The content of design science study includes the all-round knowledge, methods, tools, management related to this system in the design. The focus of design science study is the renewal of knowledge used to manufacture articles that makes the human society be harmonious with the natural world. At present, the trend of design science study is to develop a set of scientific and systematic theory of design science out of design studies at various levels and in all fields. (Liu, 2010; Xie, 2017).

3.4.2 Application of Design Science Research (DSR)

Design scientific research deals with all the purposeful activities of human beings, and strives to serve the progress of society by working out ways to solve problems. In order to improve logistics efficiency and reduce logistics costs, this research designs drop-and-pull transport and LCL transport scheme. Therefore, the DSR is adopted to obtain a more scientific design.

Most of the e-commerce goods are in small batches and large variety, and the distribution destinations are dispersed. It not only needs the transshipment of the haul line and feeder transport, but also needs the storage of special goods in the multi-temperature-zone containers in the transportation process. In order to facilitate the transportation of goods, improve the transportation efficiency, and avoid excessive sorting of goods and disconnected transportation of goods at the logistics nodes, this research aims to upgrade and improve the facilities and equipment, and the design idea of 40-foot standard containers is drawn on to design four series of standard LCL boxes.

In the design schemes, the influencing factors of many aspects are taken into consideration, such as the carrying capacity of vehicles in line haul transport, the empty weights of the first-stage standard box, the second-stage large standard box, the second-stage small standard box and the third-stage standard box, and the 13 kinds of logistics packing boxes and the 15 kinds of woven mesh bags of different specifications (Liu et al.,2015; Liu et al., 2016).

In the four standard LCL box design schemes, the standard LCL boxes at the same level are consistent in length and width but differ in height. The first-stage standard box needs to meet the line haul transport, feeder transport and the terminal delivery to large customers. Therefore, the length and width dimensions of it should be suitable for the transportation by the semi-trailers in line haul transport and by the urban distribution vehicles. The second-stage large standard box and the second-stage small standard box are mainly used for the feeder transport and urban distribution for small customers. Therefore, the length and width of them are designed in line with the requirements of mixed-loading of first-stage and second-stage standard boxes, so there is an integer proportional relationship between the size of first-stage standard boxes and that of the second-stage standard LCL boxes. The third-stage standard box is used for the terminal delivery of individual small customers. Therefore, the loading weight, loading size and other parameter indicators of the mini-vehicle for terminal delivery are considered in its design.

Then, with the help of Autoload 10.0 and simulation method, the goods loading and standard LCL boxes experiments on the designed standard box are conducted, so as to verify the rationality of the design of the standard LCL box and transportation strategy based on the specifications of both goods packing boxes and woven mesh bags and the transport vehicle specifications indicators.

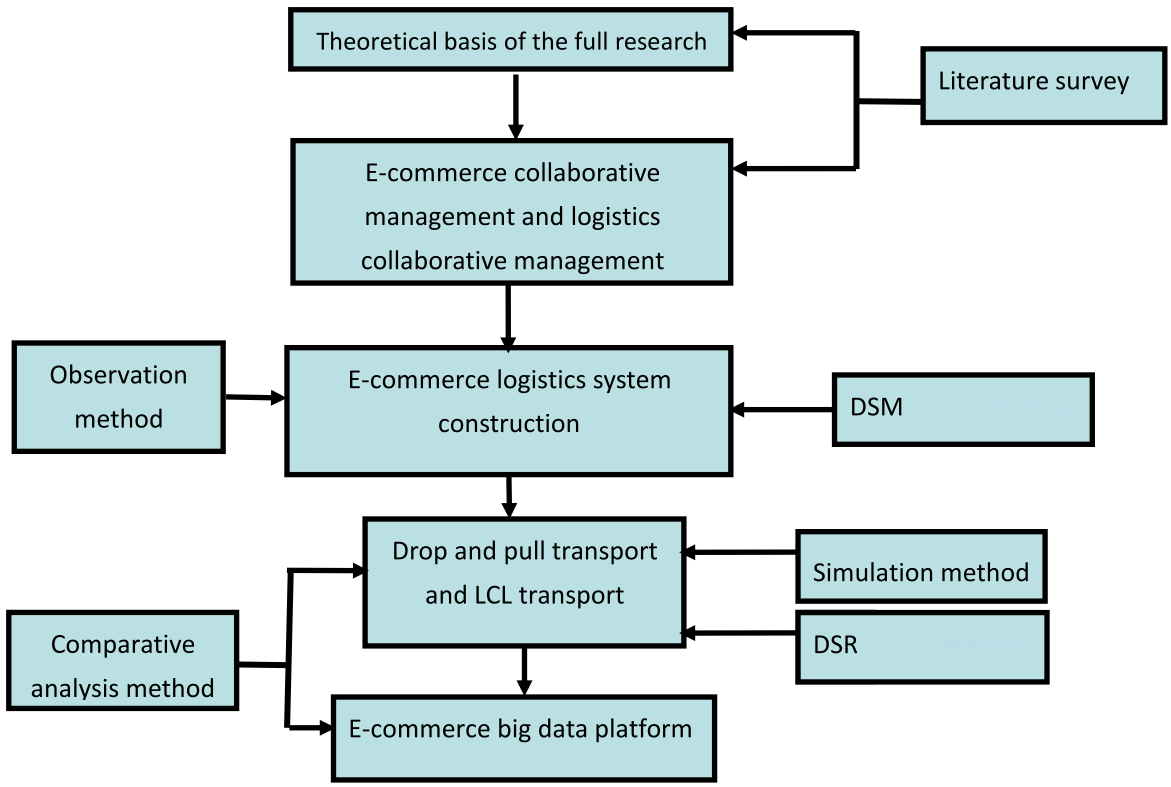
Furthermore, the shape design of the standard LCL boxes is modified to make it more scientific, reasonable, and convenient for logistics operations, thus improving logistics efficiency.

The traditional containers are transformed into four-stage standard LCL boxes, which not only saves loading space, improves the sorting efficiency, but also avoid the disconnected transportation of goods at the logistics nodes. At the same time, it facilitates the application of drop-and-pull transport, which can save a lot of sorting and loading time, improve logistics operation efficiency, and promote the e-commerce collaboration.

3.5 Summary

This thesis mainly employs literature survey method, observation method, comparative analysis method, simulation method to analyze the current situation of e-commerce and e-commerce logistics. The design structure matrix (DSM) is adopted to express the logical relationships in e-commerce logistics collaboration. Then framework design is conducted for the e-commerce collaborative management and the collaborative management of e-commerce logistics is studied and analyzed. Next, through the construction of the logistics system, the four-stage radial-spoke logistics network is established to improve in detail the system of e-commerce collaborative logistics. The layout of the network hubs is designed reasonably to realize the interconnectivity of the supply chain. The design science research (DSR) is adopted to design standard LCL boxes and transport strategy. With the improvement of facilities and equipment, a reasonable standard LCL loading scheme is designed in order to improve the degree of intensive transportation. Furthermore, under the construction of the collaborative logistics system and through integrating its own e-commerce and internal management platform, the enterprise can take advantage of its strength to improve and develop the network big data platform. Finally, taking the existing logistics enterprises as a case, the performance evaluation and risk assessment of its logistics scheme will provide reference and guidance for the future development of the enterprises. Research method logic diagram is shown as 3.2.

Figure3.2 Research method logic diagram



This chapter introduced the research methods of the thesis, and integrated the research content systematically through the research method design to make the structure of the thesis clearer. The next chapter will present theoretical basis for the research content.

Chapter 4:

The theoretical basis of the study

In the previous chapter, the design of the research method was introduced. Through the application of eight research methods, the frameworks of e-commerce collaborative management and e-commerce logistics collaborative management were proposed based on the review of literature from China and other countries. It suggests constructing an e-commerce logistics system under the collaborative theory. A variety of research methods, including both qualitative and quantitative methods, are applied comprehensively in this study.

This chapter introduces the theoretical basis of this thesis based on the research results and research method of scholars at home and abroad, namely:

- the theory of systems and systems engineering;
- the collaborative theory; and
- the project management theory.

The introduction will cover the definitions, characteristics and principles of these theories. In addition, after refining and summarising the viewpoints of scholars in China and abroad, a unique e-commerce collaborative project management system will be put forward. This will provide an important theoretical basis for the construction of a logistics system and the construction of the information platform.

Based on the research questions mentioned in chapter one, this chapter attempts to lay a theoretical foundation for the study in the following way:

- By presenting the e-commerce collaborative theory and the system approach for collaborative project management.
- By providing theoretical guidance for e-commerce collaborative management and e-commerce logistics collaborative management, as well as e-commerce collaboration.
- By presenting an improved logistics system, constructed to enhance the development of e-commerce and improve the efficiency of logistics and the entire supply chain.

These are specifically related to the research objectives of the thesis introduced in chapter one. E-commerce collaboration will improve the efficiency of supply chain and help to construct a better logistics system. With the application of the standard LCL box and drop-and-pull transport, the logistics operation processes and costs will be reduced, and finally the goal of improving logistics efficiency will be achieved.

4.1 Systems and systems engineering

Systems and systems engineering are important to e-commerce. As e-commerce itself can be regarded as a complex and large system, how to make e-commerce operate smoothly and systemically has become a very important issue of systems science (Tolk, 2013; Wippler, 2016; Cortez, et al.,2016). This section will appropriately borrow some concepts from the fields of systems and systems science.

4.1.1 Systems

4.1.1.1 The concept of systems

There are various systems in society. Every company or community can, for example, be regarded as a system. Each system is composed of different smaller parts. There are differences and connections between each smaller part. When combined, these small parts form an organic whole, thus realising a certain function. The following theories are some examples that have been proposed:

- Betaramid (1950) proposed the antibody systems theory and systems theory in biology and physics.
- Gu (2002) proposed the theory of regional innovation systems, analysed the innovation activities from the perspective of systems and initially established the theoretical framework of regional innovation systems.
- Chang (2011) divided the development of General System Theory into two stages, namely the stage of classical system theory and the stage of modern system theory.
- Qian (1981), the founder of system engineering in China, defined the system as follows “The extremely complex research subject is called a system”.
- Bertalanffy (1950) proposed the fact that certain principles have general applicability to systems and continued to explain the occurrence of isomorphic laws in different scientific fields.
- Blanchard (1988) put forward the true measures of a system. These include many different factors related to technical performance, system effectiveness, life-cycle cost, supportability, etc.

4.1.1.2 The characteristics of a system

Ducq (2012) put forward that a system is composed of a set of elements that interact with each other. Moreover, a system has boundaries and is able to evolve by itself. The elements outside a system constitute the environment of the system and make it possible for the expansion of the system.

Naudet (2009) proposed that a good system is characterised by openness, stability, predictability, etc., and features the sustainable interaction among elements of the system.

This thesis mainly summarises the following characteristics as a system after having consulted some relevant literature also relevant to logistic systems:

(1) Collectivity: A system is an organic collective. It aims to maximize the overall effect. In other words, the system as a whole should perform a more powerful function than the sum of its subsystems do (Doumeingts et al., 2009).

(2) Connectivity: In a system, all parts are connected according to certain relations. The precondition of the establishment and stable operation of a system is its connectivity (Wang, 2015).

(3) Purposefulness: Systems are built to fulfill specific functions. Systems with different purposes and functions are bound to have different structures (Doumeingts et al., 2009; Forrester,1994; Sterman,2010; Meadows,2015).

(4) Environmental adaptability: The environment is the external condition of systems. It is impossible for any system to exist independently of its environment. There are a variety of energy, substance and information exchanges between

systems and their environments. Therefore, only when it adapts to the environment can the system survive (Morgeson et al.*,* 2015; Gleissner et al., 2013; Choi et al., 2016).

Systems are ubiquitous in all fields of society.

In conclusion, understanding the concepts and characteristics of a system may also help to lay a solid theoretical foundation for future research on the issues related to e-commerce project management systems.

4.1.2 Systems engineering

4.1.2.1 The concept of systems engineering

Systems engineering is made up of two elements, namely, systems and engineering. It is considered as a systematic science also in the field of engineering technology (Nielsen, et al., 2015; Wilkinson, et al.,2014).

The concept of systems engineering can be traced back to Bell Labs in 1940 (Anderson et al., 2014). It is employed by various industries (especially the US military industry) that have demands of understanding and manipulating the whole characteristic of a system (that may be much larger than the aggregate of these complex engineering projects).

The American Society for Quality Management Systems Committee (1969), [Japan] Terno Shrine (1971), Encyclopedia Britannica (1974) and the Great Soviet Encyclopedia (1976), Mo (2013) and Bhise (2016) provide the following basic definitions of systems engineering:

(1) Ramos (2011) redefined systems engineering and proposed model-based systems engineering. This means that all processes of organising systems can be completed through modelling languages.

(2) Sheard (2007) explained that the systems engineering process for a company is a network that can be studied by complex systems methods. It is a technique that promotes the overall coordination and efficiency from the holistic perspective of the system. From a scientific point of view, systems engineering is a systematic science that also belongs to the field of engineering technology.

(3) Qian (1978) put forward that systems engineering is a scientific method to plan, study, design, make, test and use systems.

(4) System engineering is a scientific method of common significance to all systems (Steinberg, 2001; Ross, 2016; Romanovsky, 2013; Tsai, 2005).

From the above, it can be seen that systems engineering is the integration of a set of engineering systems with the application of all kinds of knowledge to achieve the goal of the system in the most efficient way. Systems engineering is based on a solid theoretical foundation. It involves knowledge about system theory, cybernetics, information theory, operational research, game analysis and management. These also provide a theoretical basis for the collaborative management of e-commerce projects (Oppenheim et al., 2011).

4.1.2.2 The basic viewpoints of systems engineering

Chesna (1967), Japanese industrial standard JIS8121 (1967), [United States] Morton (1967), Qian (1978), Cavalieri et al. (2012), Grossmann et al. (2010), Boehm *et al*. (2010) and other scholars have understood and defined systems engineering. There are many viewpoints on systems engineering. The basic points also related to e-commerce systems and projects are generally as follows:

(1) System: Systems engineering treats the entire e-commerce system (as discussed in this thesis) as a whole, and tries to identify problems and connections in the whole system.

(2) Overall optimisation: A project is regarded as a whole system; all serve the overall interests and the overall situation is taken into consideration.

(3) Creativity: E-commerce, as evaluated in this thesis, can be regarded as a complex engineering system whose development may encounter risks and challenges. It is therefore necessary to be innovative and creative to put new technologies and ideas into practice so as to improve efficiency.

(4) Collaboration: In systems engineering, in order to maximize profits, subsystems must work collaboratively to produce optimal results.

(5) Dynamic nature: The users' needs are constantly changing, rivals never stop to pose new challenges and technologies are innovated every day (Dahmann, et al., 2012). E-commerce by its very nature is dynamic, as its goals and demands are constantly changing. This can also be related to the field of system dynamics (e.g. Forrester (1994); Sterman (2010); George (2015)).

4.1.2.3 The methodology of systems engineering

The philosophy of a three-dimensional system in systems engineering, such as the Holzer structure, is regarded as a methodological basis of systems engineering. Hall three-dimensional structure, also known as Hall's system engineering, is a system engineering methodology proposed by American system engineering expert Hall and others in 1969 based on a large number of engineering practices. The content is reflected in the three-dimensional structure diagram that can visually display the various work contents of system engineering. Hall three-dimensional structure embodies the characteristics of system engineering, integration, optimisation, proceduralisation and standardisation of system engineering methods , which is the important basic content of system engineering methodology （Wu et al., 2014; He et al.,2014; Wenan et al., 2013）. This system engineering methodology is proposed by the American systems engineering expert, Hall (1969). It provides a unified thinking mode to solve the planning, organisation and management problems of large and complex systems. It divides the entire process of systems engineering into seven closely-related stages or steps considering the various expertise and skills required to complete these phases and steps. Therefore, a three-dimensional structure consisting of time dimension, logic dimension and knowledge dimension is formed (Hirsch, 2012; Brusa et al., 2018; Fusaro et al., 2016).

- In the time dimension, systems engineering is divided into seven phases, namely, planning, drafting plan, analysis, production, debugging, operation and updating.

- In the logic dimension, it is divided into seven steps, namely, clarifying the problem, system index design, system integration, system analysis, system optimisation, merit-based decision and plan implementation.
- In the knowledge dimension, it is divided into six categories, namely, natural science, social science, management science, economics, engineering technology and Information Technology.

This three-dimensional structure is quite complex, usually used in relatively large systems. Its basic idea is to (Blanchard, 2008):

- identify problems and establish causes;
- set objectives;
- brainstorm feasible plans;
- analyse and choose the best option; and
- implement the option.

Systems engineering is basically a working procedure with wide applicability. Therefore, in the research of an e-commerce project management system, the systems engineering mode has also been adopted in this thesis.

E-commerce operation is a large and complex system as a whole. Therefore, it is necessary to understand the definition and composition of the system through the methodology and fundamentals of systems engineering. The related collaborative theory will be introduced in the next section.

4.2 Fundamental Basis of Collaborative Theory

Collaborative theory is interdisciplinary and addresses the characteristics and rules of different types of systems in which various subsystems are both in conflict and coordination with each other, but jointly promote the formation of a new orderly state of the system (Gu et al., 2011; Dickinson et al., 2014; Berger, 2014),

Collaborative theory helps to:

- coordinate different subsystems;
- eliminate their contradictions:
- seek their common grounds while reserving their differences; and
- present an overall effect of the system.

It is aimed at addressing the mechanism, conditions and rules of the transformation of an open system from being chaotic and disorderly to orderly; from low-level order to high-level order.

The founder of collaborative theory is Haken (1971), a well-known physicist and professor at the University of Stuttgart in the Federal Republic of Germany. He provided a systematic discussion of the topic (Haken,1977; Gu et al., 2011; Yu, 2016).

E-commerce, as a new way of Internet business activity, has become an important industry in the modern service sector, providing enterprises with a virtual global trading environment and opening up new markets. It not only greatly shortens the distance in global trade, but also produces a new type of business model for direct communication between enterprises and consumers, making transactions between commodity providers and customers simpler and more efficient, allowing enterprises to focus more on meeting customer needs, improving service quality, and bringing real and long-term benefits to enterprises and individuals. Therefore, this new business model is being accepted by more and more consumer groups due to its convenience and quickness.

In view of the current status, thee-commerce in China is more like a newly emerging thing which is on a critical stage of growth and development and shows a strong momentum. It is developing rapidly and has great potential. As a whole transaction process, the content of e-commerce is closely related to people's daily life, not just limited to online shopping but becoming more and more diversified.. With the constant expansion and ever growing consumer groups, e-commerce will inevitably promote the development of relevant industries. All in all, future e-commerce in China will feature more and more detailed division and multiple and perfect functions.

However, the operation of the e-commerce system is a complex and dynamic process and still faces many problems. On the one hand, the e-commerce system is not well integrated with the departments of enterprises, and the supply chain is not connected. On the other hand, the logistics network is imperfect, and the terminal distribution efficiency is low but the cost is high. Therefore, considering many unfavorable factors, the operation of the e-commerce system needs to be based on collaborative theory: continuously optimizing the resource allocation among the constituent elements, coordinating the relationship between the members of the system so as to make them produce collaborative benefits through collaboration and resource sharing, bridging the time and space gap in e-commerce, opening the door to real-time information interaction, overcoming the problems of the first-mile and last-mile delivery in the supply chain, and giving full play to the core value of the combination of business flow, logistics, capital flow, and information flow. All the efforts are made to move e-commerce into a new development stage featuring ever growing scale, continuously optimizing structure, and increasing vitality.

4.2.1 The basic concepts of collaborative theory

4.2.1.1 Phase change

The transition between the different aggregation states of the various subsystems of the system is called phase change. Here the aggregation state of systems or subsystems is a phase. When the phase of a system changes abruptly, mutations occur. This is a common critical phenomenon (Ansell et al., 2008).

4.2.1.2 Order parameter

The parameter that indicates the phase change of the system is called the order parameter. It indicates orderly structures and the type of systems. It also reflects the degree of collaboration of various subsystems. It originates from the collaboration and cooperation between subsystems and plays a role in governing the behavior of systems and subsystems (Rajaram et al., 2010).

4.2.1.3 Fluctuation

In a complex system, there are usually independent movements of subsystems and various possible local couplings between subsystems. In addition, the environmental conditions of the system may also change randomly. These are reflected in the instantaneous values of the macroscopic quantity of the system. These instantaneous values often deviate from their mean values and appear as fluctuations. This phenomenon is called fluctuation (Ansell et al., 2008).

4.2.2 The basic principles of collaborative theory

According to Haken, there are three principles of collaborative theory, namely, the principle of instability, the principle of domination and the principle of order parameters (Vangen, 2003).

4.2.2.1 Principle of instability

Collaborative theory, starting from the study of the rules of orderly evolution of the system structure, defines instability through a phase change mechanism and admits the positive and constructive role of instability. The various orderly evolution phenomena of the system are related to instability. In the disintegration of the old structure and the forming of the new structure, instability acts as the medium in the structural evolution of the system. To some extent, collaborative theory can be regarded as the theory to study instability.

4.2.2.2 Principle of domination

According to the principle of domination, ordered structures are determined by a few slowly increasing unsteady modes or variables and all subsystems are governed by these few unstable modes. By these slow variables, the evolution of the system can be described. The core method of the application of domination principle is the adiabatic elimination method (Xiao et al., 2011). It will be described in more detail hereafter.

4.2.2.3 Principle of order parameter

Mainly referring to the order parameter related to the phase change theory, the order parameter principle can also replace the concept of entropy in the dissipative structure theory (Liu, 2010). As a quantitative concept and judgment of different types and degrees of the ordered structure, this principle can describe and deal with self-organisation.

As a macroscopic parameter, the order parameter is the product of the collective movement of the microscopic subsystems and the representation and measurement of the cooperative effect. It also governs the behavior of subsystems and dominates the overall evolution of the system. Collaborative theory establishes and calculates the order of parameter equations by determining the order parameters of the system, and finally achieves the self-organisation of systems.

4.2.3 Basic features of collaborative theory

By describing the basic concepts, views and principles of collaborative theory, it can be seen that it has the following features:

(1) Yu (2016) proposed that the collaborative mechanism of an e-commerce ecosystem is not achieved overnight. It is a process that goes from being an unbalanced state to a balanced state through the self-organising function.

(2) Mcafee (2012) put forward collaborative effect as the sum of the common, complementary and synchronised effects of resources or assets.

Some efforts have been made in this thesis to determine the basic characteristics of collaborative theory, including consulting relevant literature (Stelter, 2014; Eschler et al., 2015), contrasting and comparing studies at home in China and abroad, and comprehensively analysing the application of collaborative theory in various fields. The basic characteristics of collaborative theory are summarised as follows:

(1) collaborative theory studies open and complex systems;

(2) collaborative theory studies a dynamic system;

(3) collaborative theory studies the existence of complex non-linear effects in systems;

(4) collaborative theory studies fluctuations of the system;

(5) collaborative theory analyses the cooperative phenomenon, rules and functions of the system, which enable the system to work together to obtain its overall positive effect and achieve system optimisation;

(6) collaborative theory studies the organisation and self-organisation of the system (a theory of self-organisation).

Haken (1989) believed that if a system is in a time, space or functional process without specific external interference, the system will be self-organising.

Wu (2015) put forward that self-organisation collaboration is the collaboration of the enterprise system with human core elements. Therefore, the self-organisation ability that is uniquely "human" plays a key role in the strategic synergy of enterprises.

The goal of collaborative theory is to deal with the complex contradictions in the system with unified views established. It uses a combination of dynamics and statistics as its basic method. The inevitability of the system is derived from the dynamics and its randomness, concluded through statistics, both of which jointly determine the movement and transformation of the system. The disorder is transformed into order in different fields, hence forming common laws and characteristics.

Modern complex systems are a compound system (Vanhoucke,2013; Lewis, 2016), therefore it is also necessary to refer to the theory of project management when applying collaborative theory. This will be discussed in appropriate detail in the next section.

The development and application of new technologies have new requirements for system and system engineering. Modern complex systems are no longer confined in a single industry, but complex project systems combining multiple projects. Therefore, the application of collaborative theory in system and system engineering is closely related to project management theory.

4.3 Project management theory

Since the 1990s, the business environment and working environment of enterprises have changed. This mainly manifests through new technologies that have become an extremely important factor for the survival of many enterprises. Furthermore, interdisciplinary and cross-regional project work teams have changed the working environment. These changes have promoted the need for the management of complex project systems and enhanced the requirements for project management (Hanisch et al., 2012; Conforto et al., 2016; Eskerod et al., 2016; Jugdev et al., 2013).

As a system to guarantee the realization of online transactions, e-commerce can be regarded as a complex project system. Its collaborative management should be achieved based on related systems and systems engineering theories and in conformity with project management theory.

4.3.1 The characteristics of projects

When discussing project management, it is often necessary to clarify the concepts and characteristics of the project. A project is a specific task to be completed. A project as a whole is a system. In addition to the characteristics of systems, a project also has other characteristics For example, the project also features novelty, complexity, uncertainty, and strictness.(Chen et al., 2014; Richardson et al., 2010).

Bennett (1991) put forward that complexity is an important criterion in the selection of an appropriate project organisational form.

Baccarini (1996) believes that the importance of complexity to the project management process is widely acknowledged for diverse reasons.

Liu Hui (2006) proposed that the project is self-inclusive, specific and restrictive, which makes the project-based organization face many obstacles in knowledge acquisition and project learning.

Wang Dacheng (2007) proposed that a project is not only an increasingly common form of organization, but also an increasingly important form of organization, and it affects the complex process of product development and innovation. In this process, the efficiency of knowledge transfer has a great impact on the successful product development.

A project is a task to be completed in a specific environment, with limited available time and resources, in order to achieve a specific goal. For an e-commerce enterprise, the key to its business development is to form its unique competitive edge. Seeing the e-commerce project from a holistic view, and based on the characteristics of projects, this thesis will discuss the e-commerce collaborative theory and the system approach for collaborative framework project management so as to help sharpen the competitive edge of e-commerce enterprises.

4.3.1.1 Life cycle

As each organism has its own life cycle, projects have their own life cycles (Akinola, 2014; Bambang et al., 2013). The life cycle of the project refers to the time elapsing from its birth to its conclusion.

4.3.1.2 Uncertainty

All projects carry some form of risk. For example, it may be difficult to define goals, or estimate time schedules and expenditures accurately. This means that it is virtually impossible to completely eliminate the uncertainty of a project. Wu (2004), for example, put forward that the complexity and the dynamic characteristics of the process of the project result in the uncertainty (Jeffrey et al., 2015; Viktor et al., 2018).

Herroelen (2005) held that the vast majority of the research efforts in project scheduling assume complete information about the scheduling problem to be solved and a static deterministic environment within which the pre-computed baseline schedule will be executed. However, in the real world, project activities are subject to considerable uncertainty, which is gradually resolved during the project execution（Fu et al., 2016）.

4.3.1.3 Conflicts

The environment in which a project manager works is never free from conflicts. This is manifested by the contradiction between resources and personnel allocation, competition for resources between different projects, and conflicts between project members.

No matter what the project is, it is aimed at ensuring the realisation of its main goals, i.e. performance and cost. Therefore, the overall goal of a project is concerned with performance, time and cost (Peled et al., 2013; Shishodia et al., 2018). However, customer expectations are increasingly involved in the project objectives in the current market environment. This extends the scope of the project. It also increases the uncertainty of the project and demanding higher requirements for project management at the same time (Conchuir, 2011; Sha, 2010).

4.3.1.4 Project management systems

The project management system can be divided into three levels (Ding, 2010; Zhou et al., 2012; Zeng et al., 2011).

(1) The first level: Factors of human resources, finance and goods form the basis that act as the basic objects of project management. Project management deals with and coordinates resource allocation and the dynamic matching of the three aspects.

(2) The second level: Factors such as information, organisation, culture and methods are not only the basis for project management, but also for its environment and tools. Organisation refers to the coordination between personnel (Osterhage, 2014; Hardy, 2016). Culture reflects values, beliefs and behaviors. Information includes historical information and information about the

status quo that provides basic data for project management and can be applied to system description and control. Methods are tools for work, including the technical methods used for project management, such as Gantt charts (Kong et al., 2012).

(3) The third level: Plan and control are the specific contents and means of project management, including the definition of the project, schedule planning, cost control, quality control and resource control. Planning and control are the contents and means of project management.

Planning is the scheduling by the managers according to the project management objectives, in addition to the detailed divisions and arrangements in project management (Wang et al., 2017; Ecosystem, 2016).

Control is a component of project management. When the specific schedule is made, the project may deviate from the schedule due to internal and external uncertainties. For example, the quality of products and services or the consumption of resources may deviate from the expectations. Therefore, the project should be in control so that it meets its desired direction and objectives. Control in project management generally includes cost control, quality control and resources control (Zhang, 2014; Goh et al., 2013; Korhonen et al., 2014).

4.3.2 The process of project management

As for the whole dynamic process, project management can be divided into the following five stages (Kong et al., 2012; Zhang, 2017):

(1) Project approval: To set up a project or a project phase.

(2) Plan: To set up and stick to a feasible plan so as to complete the project.

(3) Implementation: To coordinate human resources and other resources to implement the project plan.

(4) Control: To ensure the realisation of project objectives by means of monitoring, process management and turning to remedies when required.

(5) Completion: The formal acceptance of the project or project stage and the orderly and successful closure of the project.

Each stage of the project management process is characterised by the completion of certain tasks. The five stages are not independent, but interrelated. The connecting, matching and coordination between stages are key to successful project management, and this is what collaborative management concentrates on (Li, 2012； Azanha et al., 2017; Vanhoucke, 2013).

Teamwork has become indispensable for social development and also necessary to project management in systems. It calls for coordination and cooperation among the various subsystems.

The success of the project is affected by many factors. In order to achieve the goal, project management methods are used in many systems. Project management has turned out to be a powerful tool for organisations and assists organisations to enhance their ability to plan, implement and control many kinds of activities. Meanwhile, it also provides a way for organisations to make fair use of their personnel and resources (Zhang, 2011; Szymczak et al., 2013; Sokhanvar, et al., 2014).

With proper project management, project costs are reduced, project development cycles are shortened and project implementation reliability is improved. With the increase of project numbers and scales in recent years, the difficulty of project implementation is also increasing, since the simple implementation of the project is no longer factor concerned (Lewis, 2016; Flyvbjerg, 2013; Flyvbjerg, 2014). The requirements for the profitability of projects are also more demanding (Han, 2014). The major factors affecting project management are changing customer demands, continuous technological innovation and the globalisation of production areas (Yang et al., 2010). Project management has thus become increasingly important in the development of a national economy.

4.4 Summary

This chapter started with the research objectives (see 1.4 section) of the study and analysed the concepts of systems and systems engineering, collaborative theory and project management theory in appropriate detail in relation to their concepts, characteristics, basic viewpoints and basic principles.

It reviewed and summarised relevant research at home in China and abroad to establish a more complete academic system so as to provide a theoretical basis for the following chapters. With the support of the three theories presented in this chapter, the following chapters will focus on the realisation of the research objectives for this thesis also stated previously. From the perspective of systems, the viewpoints of the collaborative management of e-commerce and the collaborative management of e-commerce logistics are proposed in the following chapters. The aim is to optimise the whole supply chain through planning and design.

Chapter 5:

Collaborative management of e-commerce

The theoretical basis of the study was described in the previous chapter. The related concepts of systems and systems engineering, collaborative theory and project management theory were introduced in appropriate detail. This has been provided as theoretical support for the following parts: e-commerce collaborative project management, e-commerce logistics collaborative management, e-commerce logistics system construction, logistics and transportation planning and design, and the improvement of e-commerce big data platforms.

Through the above elaboration on systems engineering and collaborative theory, the concept of e-commerce collaborative management will be proposed in this chapter to strengthen e-commerce collaboration.

Based on the analysis and a consideration of e-commerce collaboration, the framework for e-commerce collaborative management design is proposed, adhering to the basic principles of the collaborative management of e-commerce projects (Mu, 2013; Xiao et al., 2014; Zhao et al., 2014). This thesis is based on the five basic principles to design the framework, which are win-win, resource sharing, complementary, seeking common ground while storage, real-time interaction principles respectively.(Yu, 2016; Xie, 2019)

The design structure matrix is a binary square matrix with n rows and n columns. This is a matrix tool for analysing and planning the product development process that is framework design of e-commerce collaborative management (Tang et al., 2010; Wierenga et al., 2008). The e-commerce collaborative theory will promote and e-commerce collaboration strengthened.

As a kind of knowledge system about design, design science study not only conforms to the laws of nature but also satisfies social laws. It is a science that crosses the boundary between natural science and humanities and social sciences. The DSR method is employed in this chapter to analyse the main problems of e-commerce collaboration (Zhuang, 2012; Xie, 2017). Considering the basic characteristics of e-commerce projects, an e-commerce collaborative theory framework is designed to guide the development of e-commerce enterprises, and promote the application of e-commerce collaborative theory and the development of e-commerce collaboration.(Briantono et al., 2019; Hong et al, 2019)

Based on the relevant theories of e-commerce project systems, this chapter will propose a new perspective for the collaborative management of e-commerce projects. Based on DSM and other research methods, through a systematic analysis of the problems encountered in e-commerce collaboration, the e-commerce collaborative theory framework will be designed and collaborative theory will be applied to e-commerce logistics systems. Moreover, the study employs the design structure matrix to display the collaborative relationships of the elements in the management framework (see section 3.2 section). At the same time, the collaborative theory and cloud platform are combined in a novel manner. In this manner, based on the existing network platform， the cloud platform will take advantage of e-commerce's advantages in network big data and focus on optimising the network platform. Besides, logistics alliance, e-commerce and the management system will be integrated to achieve collaborative management. What’s more, effective management of the ever-increasing information is realized, and information between the various process steps can be exchanged and communicated in a timely and accurate manner, thus aiming to improve operational efficiency and enhancing enterprise competitiveness.

This helps enterprises to construct an improved logistics system in collaborative management and thus remain competitive in the market.

5.1 Collaborative management of e-commerce projects

In recent years, collaborative theory has been applied in many fields and great progress has been made in its study (Zhu, 2011; Dickinsonet al., 2014; Berger, 2014). For example, it has largely promoted the development of system science, especially the development of e-commerce and logistics collaboration (Clarke et al., 2006; Balakrishnan et al., 2010). Therefore, collaborative theory is of significance for the completion of an e-commerce project.

This research applies collaborative management to e-commerce projects in this chapter. Specifically, it discusses the characteristics of the e-commerce project system by viewing it from the system perspective. Based on the basic principles of e-commerce collaborative project management, it introduces the idea of collaboration into e-commerce management and e-commerce logistics in a novel manner. A framework of e-commerce management is thus established with the help of collaborative theory. The cloud platform is also improved with the introduction of collaborative theory. With the introduction of collaborative theory, the whole process of e-commerce logistics may be integrated and its efficiency improved. Through the e-commerce collaborative management framework, a four-stage radial-spoke network is designed; standard LCL boxes are combined with drop-and-dull transport. Furthermore， the data sharing function of big data platforms is improved and the cloud platform is improved to build a "platform plus supply chain" framework and bridge the gap between the first-mile and last-mile delivery in the e-commerce supply chain, which not only improves the efficiency of logistics operations for e-commerce, such as loading efficiency in e-commerce、transportation efficiency in drop-and-pull, but also has lays a good foundation for e-commerce collaboration.

E-commerce collaboration will help to construct a better logistics system. When the e-commerce collaborative management is facilitated, logistics operation efficiency as a whole will be improved, logistics costs and risks lowered, and the research goals in this thesis achieved.

5.1.1 Characteristics of e-commerce project management

Because e-commerce projects fundamentally require collaboration or connection among all parties, collaborative management may be a good choice for an e-commerce project.

Characteristics of e-commerce project systems Include the following (Alaa et al., 2004; Liu, 2015):

The e-commerce project system is a system that guarantees the completion of e-commerce-based online transactions and is a network system designed for e-commerce activities.

(1) E-commerce project management can be considered as an open and complex system.

Successful e-commerce operation is the result of the concerted effort of several departments. The departments involved should be complementary and tolerant of each other, learn from each other, and work collaboratively (Yadav et al., 2010). For project operation, work finished separately by each department cannot necessarily give play to its strengths in order to generate more profits (Fong et al., 2000). Achieving collaboration among departments has therefore become a most important issue in e-commerce management (Xiao, 2009; Song, 2014). A big project usually consists of many intertwined branches that add to the complexity of e-commerce project systems. (Zhang et al., 2017)

(2) Fluctuations exist in e-commerce project management

E-commerce project management is never really free from contradictions (Zhang, 2012). If these contradictions cannot be resolved, the e-commerce project may be affected and mutation (that is, phase change), (see in 4.2.1.1section), (Jeffrey et al., 2015;Antoni et al., 2014) will thus occur. This shows that fluctuations exist within systems (Weiss, 2001).

As similar to collaborative theory, in the process of coordination and cooperation between different subsystems, there are usually independent movements of subsystems and various possible local couplings between subsystems (Couture et al., 2018). In addition, the environmental conditions of the system also change randomly. These are reflected in the system. This phenomenon is called fluctuation.(Yu, 2018)

(3) E-commerce project management is a dynamic system

Since e-commerce evolves based on the evolution of the internet, the whole e-commerce project remains dynamic (Rusnjak et al., 2010). User needs are constantly changing; competitors never pause to pose new challenges and technologies are innovated frequently (Fong et al., 2009; Trad et al., 2016; Cheah, et al., 2014). E-commerce is therefore dynamic in nature, since its goals and demands are constantly changing.

(4) E-commerce project management is an innovation system with creativity

E-commerce is a new product, along with the rise of the internet. Meanwhile, the development of e-commerce will face more risks and challenges. It is innovative and creative to put new technologies and ideas into practice so as to improve efficiency (Niederman, 2005). Therefore, emphasis should be placed on the technology information work and information organisation, as well as on management in e-commerce projects (Trad et al., 2016).

5.1.2 Basic principles of e-commerce collaborative project management

Cooperation is not only a major trend of social development, but it is also what e-commerce strives for (Hill et al., 2010; Ji et al., 2016; Wojtek, 2015). Nowadays, new knowledge and skills are updated frequently, competition is becoming increasingly intense, and social needs are becoming more and more diverse.

E-commerce is facing both challenges and risks, such as logistics, information and management risks. Meanwhile customer demands are more personalised. Obviously, it is difficult for e-commerce enterprises to earn a place in the market by themselves (Qi et al., 2018). Therefore, collaboration is necessary in e-commerce activities. E-commerce enterprises should establish both internal collaborations and external collaborations with other parties involved in the supply chain or other social sectors. These collaborations are interactive and value-adding (Guo et al., 2010; Dan et al., 2015; Akter et al., 2016).

Collaborative theory will therefore play an irreplaceable role in e-commerce logistics in the future (Hristoski et al., 2017). As a complex project system， e-commerce collaborative management needs to follow the basic principles of collaborative theory. Its basic principles in addition to and in support of what has been discussed before are as follows expanded on from the previous chapter (Hill et al., 2010):

(1) Principle of win-win

Only when collaboration can bring benefits to both parties can long-term collaboration be established. In the long run, collaboration can achieve greater benefits (Guo et al., 2010; Gao et al., 2016).

(2) Principle of resources sharing

In the process of collaboration, the parties should achieve the sharing of resources to make effective use of resources to the largest extent and at lower cost (Mohammadjafari et al., 2011; Han, 2014).

(3) Principle of complementarity (Cong, 2010; Zhao et al.,2014)

All parties involved in the supply chain should be complementary to each other. The advantages of your partner will be transformed into your own advantages through cooperation. The cooperative parties draw on the strengths of others and make up for their weaknesses, thus generating more profits for both parties.

(4) Principle of seeking common ground while reserving differences (Zhang, 2017)

In the process of collaboration, differences between enterprises are inevitable. The key to bringing benefits to each side is thus to find things that they have in common and seek common ground, while reserving differences (Sun et al., 2009; Gao et al., 2016; Liu et al., 2016).

(5) Principle of real-time interaction

Information blocking and communication delay are fatal in the process of collaboration (Cordeiro, 2003; Zhang et al.,2017; Yang, 2014). Ways in which to realise real-time interaction has therefore become an important issue.

Adhering to the basic principles of the collaborative theory is one of the prerequisites for e-commerce collaborative project management. In addition, it is necessary to analyse the e-commerce collaboration problems with a holistic view.(Wang, 2019)

5.2 Problems of e-commerce collaboration

E-commerce projects are complex systems and their development process involves many aspects entailing for example systems engineering (Trad et al., 2016; Khokhar et al., 2013). Such complex systems consist of many mutually dependent, but contradictory subsystems. The application of collaborative theory is to coordinate different subsystems, eliminate their contradictions, seek their common grounds while reserving their differences, and finally to form a complete and scientific management system. This means realising that the collaborative management of e-commerce projects faces many challenges (Wu et al., 2018). The main problems of e-commerce collaboration are as follows:

(1) Poor response sensitivity of logistics systems to changes

Big data processing systems of e-commerce enterprises can accurately anticipate changes in customer demands, but logistics warehouses' and delivery nodes' sensitivity to changes are too poor to adapt to the speed of information changes. As a result, logistics systems cannot fully keep pace with times, thus lowering customer satisfaction (Kokkinaki et al., 1999; Liao et al.,2014; Ying et al., 2017).

(2) Defective connection of the supply chain

In a large-scale supply chain such as an e-commerce supply chain, all suppliers involved in all nodes of the supply chain adopt their own management style and mode. Therefore, it is difficult for them to fully coordinate with each other (Luckett, 2004; Jian et al., 2015; Lu et al., 2015). Poor coordination among all parties will also result in low efficiency of the logistics systems.

(3) Information asymmetry

Every enterprise continues to display its own competitive advantages in operation and management methods. Therefore， all parties involved in a supply chain should avoid information disclosure and protect enterprises from losses thus incurred. Since the logistics process is complicated, all parties involved should collaborate with each other in the process (Zhang et al., 2017). However, it is common to see problems like logistics resources waste, damage of goods, and logistics costs increase caused by information asymmetry in the logistics process the (Stevens, 1989; Zhang, 2013).

(4) Protection of common interests

In e-commerce activities, common interests and conflicts of interest among all the participants or sectors coexist due to time and space differences. In order to be competitive in logistics, it is necessary to achieve all-round integration of all parties involved, and make businesses more flexible and the logistics system more adaptable (Vachon et al., 2006; Couture et al., 2018; Wu et al.,2015). Furthermore, with the goal of maximising the benefits of the whole supply chain, it is necessary to find a better balancing point and weigh the interests of all parties when it comes to conflict of interest.(Hu, 2018)

Based on the above analysis of the problems in e-commerce collaboration, the following section will employ collaborative theory to consider some solutions to various problems from the system perspective. The e-commerce collaborative theory framework is also designed. In what follows, DSR method will also be employed (Xie, 2017; Zhuang, 2012). A new e-commerce collaborative theory framework is designed by taking the challenges and risks encountered in the development of e-commerce collaboration and utilising innovative technologies and ideas. In this process, the subsystems of e-commerce enterprises will be coordinated so that they can seek common ground and reserve differences. (Zhang, 2019)

5.3 Framework design of e-commerce collaborative theory

This research aims to apply collaborative theory to the construction of a logistics system. With the help of online big data platform analysis, the logistics process is integrated and the supply chain is improved, thus the overall operational efficiency enhanced.

Design science deals with all the purposeful activities of human beings. It seeks to meet people’s demands for novelty, serve a better life of human beings and the progress of society by working out ways to solve problems. The design of the e-commerce collaborative theory framework draws on the DSR concept and creates the e-commerce management model to improve operational efficiency and reduce logistics costs.

In the construction of the entire logistics system, the following is undertaken:

- The document analysis method is employed to deeply understand and analyse the collaborative theory.
- The observation methods are employed to observe the existing operation mode and development status of the e-commerce logistics platform.
- The four-stage radial-spoke logistics network is constructed.
- Drawing on the DSR design concept, the four-stage radial-spoke logistics network is designed with the help of collaborative theory. The logistics nodes are systematically planned to make the whole logistics network work together based on the logical relationship of e-commerce logistics collaboration (Xie, 2017; Zhang, 2012).

- The layout of the network hubs is designed in a scientific manner, which will be helpful to improve logistics efficiency.
- The comparative analysis and simulation methods are employed to design the standard LCL boxes and make the cargo loading experiment.
- The comparative analysis method is also applied to the transformation and innovation of the big data platform to ensure the smooth flow of information and achieve efficient operation.

The specific application of the e-commerce logistics collaborative theory is as follows:

Part of the new contributions of this thesis is that based on the collaborative theory, this thesis then establishes the four-stage radial-spoke logistics system, and designs four series standard LCL boxes and makes reasonable use of the drop-and-pull transport, realizing efficient transportation of goods through collaborative management of all parties. Furthermore, the collaborative theory is integrated and combined with the cloud platform, and the big data platform is used to promote the collaborative efforts of all parties involved in the supply chain and rationally plan logistics activities, strengthen resource integration, actively improve the logistics network, so as to improve logistics efficiency.In this thesis, the data sharing function of big data platform is improved, and the "platform plus supply chain" framework is constructed to promote information sharing among all parties involved in the supply chain and avoid information island phenomenon.

5.3.1 Collaborative theory of e-commerce logistics systems

E-commerce typically features a large number of small-scale orders and dispersed shipping addresses (Masimbe et al., 2014; Stoll et al., 2013). Due to the fact that the customers, logistics and distribution are dispersed, these systems face problems in terms of cost and timeliness. Moreover, with the popularity of online shopping, more and more customers make higher demands for the personalised distribution of goods (EVA， 2017; Takanobu et al., 2019). E-commerce logistics is the key for e-commerce enterprises to enhance their competitive edge. In view of the particularity of e-commerce customers, in addition to the large number of small-scale orders and dispersed shipping addresses, which are the major characteristics of e-commerce (Colla et al., 2013; Jing et al., 2017; Mackey et al., 2015), a scientific logistics system plays an important role in e-commerce logistics.

The design of a four-stage radical-spoke logistics networks mainly including e-commerce hubs, e-commerce regional distribution centres, e-commerce physical stores and e-commerce cooperatives, is implemented in this reasearch using a design science research approach (Cheah et al., 2014). The "first-mile" and "last-mile" delivery are completed in the whole logistics process and information exchange is achieved through big data to improve delivery efficiency under such a logistics network. As a part of the logistics network design in this thesis, it is also a logistics project management system.

With the help of DSR, based on collaborative theory, logistics activities are rationally planned, the radical-spoke logistics system is constructed and the sites and functions of logistics nodes are rationally planned, and the facilities and equipment are actively improved to promote their standardisation and improve the efficiency of logistics operations. Simultaneously, the information platform is constructed to promote the information intercommunication among all parties involved in the supply chain and the supply chain resources are integrated (Chen,2013; Xing et al, 2016).

Under the guidance of collaborative theory, this research aims to integrate the businesses of the logistics process and construct a new logistics system across the country in China. The collaboration of all parties involved in the logistics network makes the supply chain completer and more cohesive. Meanwhile, this thesis adopts the design structure matrix (DSM) to express the logical relationships in the e-commerce logistics collaboration (see section 3.3). The analysis of the relevant e-commerce logistics collaborative theory as part of this is as follows:

(1) Business process integration for the logistics process is completed and the "platform-plus-supply-chain" framework is designed with the help of collaborative theory.

The context of this is as follows: In a specific operation and implementation of the entire logistics network, once the goods have been collected by the source of the supply chain, via terminal nodes, they are dispatched to the e-commerce regional distribution centres through the vehicle dispatching platform (Gholamian et al., 2017; Slimani et al., 2014).

Then, after simple processing in the centres, the goods are loaded in the first or second-level cold-boxes according to the condition of the goods and the order, during which later sorting should be avoided as much as possible, and one box for one order is recommended. Then, these boxes are transported to the e-commerce hub by means of drop and pull transport (Wang et al., 2014; Li et al., 2015; Zhong et al., 2013). The first-level standard boxes are loaded according to directions, fastened in a special and specific way, and then transported by line haul to the destination e-commerce hub, where they will be sorted and packed according to customer orders. If sorting or packing is not necessary, they will be directly shifted to another line haul vehicle and be transported to the e-commerce regional distribution centres for delivery to major customers (including e-commerce physical stores). As for goods of customers in villages and towns, they will be reloaded in the second- or third-level standard boxes in the centers and be transported by less-than-container load (LCL) to terminal nodes. Finally, the terminal nodes will achieve last-mile delivery as also explained in other sources (Leung et al., 2000).

In this way, with both the analysis of big data of the online cloud platform and coordination among all merchants involved in the supply chain under collaborative theory, the connection of "platform-plus-supply-chain" of the logistics network is completed or achieved.

The cloud platform based on the traditional network platform makes full use of the advantages of e-commerce in network big data and combines the logistics alliance and management system (Damian et al., 2016; Ravikanth, 2018). It is intended to create an integrated, comprehensive and convenient information system with the consideration of both internal and external elements, which is the improvement and development of the network big data platform. The relevant details will be introduced in Chapter 8.

(2) Integrating the supply chain through collaborative theory

Thanks to the application of collaborative theory in the whole logistics system, the supply chain should become a complete chain, and all merchants involved in the supply chain should aim to coordinate with each other efficiently, thus improving e-commerce customer satisfaction (Chen et al., 2012; Turkulainen et al., 2016).

In addition, information-sharing platforms are designed and supply chain resources are integrated. All parties involved in the supply chain aim to achieve information exchange and avoid the problem of information islands with the construction of a cloud platform.

(3) Improvement of the logistics system, facilities and equipment

In addition to the construction or design of the logistics system, facilities and equipment should be improved in order to improve logistics efficiency. Based on the standardisation of containers, sorting times are reduced and costs and time are saved. By improving the intelligence of warehouse operations, the efficiency of warehouse operations will be greatly enhanced (Iannone, 2012).

5.3.2 Collaborative theory plus cloud platform

Based on the appropriate combination of collaborative theory and cloud platform, the construction or design of the cloud platform mainly includes logistics alliance, e-commerce platforms and internal management platforms. This is again achieved using a design science research approach described elsewhere in this thesis.

Firstly, logistics alliance should be connected to e-commerce platforms and the internal management system should be connected to original e-commerce platforms.

Secondly, warehouse supervision systems should be strengthened and a visual management system established. Through collaborative theory, the efficiency of warehouses should be enhanced and a video monitoring system connected with a cloud platform (Li, 2010; Ramiro et al., 2017).

Most of the existing e-commerce enterprises operate in their own way and cannot achieve logistics alliance, which causes the signing for goods from different delivery enterprises in a single day (Chen et al., 2001). The repeated delivery, that is, delivery to a customer multiple times a day not only increases the costs of logistics enterprises, but also results in the waste of social resources. Therefore, user's information in the cloud platform should be integrated through big data in order to avoid repeated delivery (Yang et al., 2010).

According to this e-commerce management mode under collaborative theory, designed using a design science research approach, it is necessary to follow the basic principles of collaborative management of e-commerce and develop different management modes for different enterprises. In the framework of e-commerce collaborative management, a logistics system should be constructed according to the circumstances of the enterprise itself first and then collaborative management should be combined with a cloud platform.

As far as the design of the logistics system is concerned, the "four-stage radial-spoke" logistics network is designed, including the e-commerce hub, the e-commerce regional distribution centres, chain stores and convenience stores.

A detailed introduction to each element and the system construction is shown in section 6.2. This network helps to achieve the efficient transportation of goods through the collaboration of all parties.

The big data platform is also helpful to promote the collaboration of all parties in the supply chain and to remove the time and spatial barriers in logistics, thus improving logistics efficiency. The platform is based on the traditional network platform and combines the logistics alliance and management system (Chen, 2014; Suguna et al., 2016), which is a kind of integrated, comprehensive and convenient information system with the consideration of both internal and external elements. The appropriate details will be introduced in Chapter 8 as alluded to before.

All enterprises should seek common ground while reserving differences in the process of promoting collaboration and maintaining their own characteristics to remain competitive in the market.

Based on the design of the e-commerce collaborative management framework (see section 5.3), the preceding part analyses the collaborative theory of e-commerce logistics systems and the design of a four-stage radical-spoke logistics networks mainly including e-commerce hub, e-commerce regional distribution centres, e-commerce physical stores and e-commerce cooperatives. Meanwhile， the collaborative theory and the cloud platform are combined to construct a “collaborative theory plus cloud platform” framework, facilitating the information interconnection and communication of all parties involved in the supply chain and improving the efficiency of logistics operations. The following section will analyse the collaborative management of e-commerce logistics.

The e-commerce collaboration theory is proposed above, and the e-commerce collaborative management framework is designed. However, what cannot be ignored is that logistics is the core of e-commerce. The e-commerce collaborative management framework is inseparable from the collaborative management of e-commerce logistics. The ultimate goal of the whole thesis is to better apply the e-commerce collaborative theory to the logistics system, so as improve the logistics network and improve logistics efficiency. Therefore, the next section will conduct research on the collaboration in e-commerce logistics.

5.4 Collaborative management of e-commerce logistics

With the conceptual model of the collaborative management of e-commerce established (see section 5.3), the following ideas were presented in the section 5.3:

- the systematic conception of collaborative project management;
- the management mode and content of collaborative operation with collaborative logistics at its core; and
- the systematic conception to collaborative project management.

Because logistics is at the core of e-commerce, the ultimate goal of this thesis is to better apply e-commerce collaborative theory to the logistics system (Xu et al., 2014; Kucharska et al., 2016). It will then introduce the research on the e-commerce logistics collaboration hereunder.

This section discusses the collaborative management of e-commerce logistics from two aspects.

- Firstly, the problems of e-commerce logistics collaboration are analysed.
- Secondly, the importance of e-commerce logistics is discussed.

This section echoes the research questions and research objectives presented in the first chapter (see section 1.3 and 1.4). On the basis of the section 5.3 of e-commerce collaborative management, in-depth study is carried out on the core link of e-commerce development, namely e-commerce logistics. It is aimed to better apply e-commerce collaborative theory to the logistics system so as to improve logistics efficiency. At the same time, it attempts to provide theoretical support for the design of the e-commerce logistics system.

5.4.1 Problem analysis of e-commerce logistics collaboration

Currently e-commerce is developing rapidly. However, the development of the logistics industry cannot maintain pace with it (Xiao et al., 2014; Xiao,2013). This restricts the development of e-commerce to a certain extent. The analysis of the e-commerce logistics collaboration is as follows:

(1) Existing logistics systems cannot support the rapid development of e-commerce

The most important concern of e-commerce enterprises is how to deliver goods at lower cost after customers place orders online. The key to this problem is to create a better logistics system. With the pace of the growth of the economy in China, e-commerce is developing rapidly, but the logistics industry nowadays lags behind and cannot always support the development of e-commerce (Yu et al., 2016; Chen et al., 2013；Ying et al., 2016; Colla et al.,2013).

(2) Poor logistics services hinder the expansion of the e-commerce platform

Logistics eliminate the time-and-space barriers in e-commerce, but customers' complaints about logistics services may aggravate their dissatisfaction with e-commerce. Approximately 16% of online consumers are not satisfied with online shopping, mainly because of the poor quality of the goods and slow delivery (Wang et al., 2014). Among all these complaints, slow delivery has reached 11.4% and the complaint about loss of goods has reached 4.7% (Jiao, 2016). The quality and capability of e-commerce-related logistics services therefore have to be improved (Lim et al., 2018; Tu et al., 2018).

With the help of collaborative theory and the application of the methods of system science, investigation and analysis, analog simulation, system modelling, standardisation systems and other specific methods, this research strives further to solve the related problems in logistics system construction from the perspective of systems.

It aims to improve the logistics system through e-commerce collaboration employed system science, investigation and analysis, system modelling method. For example, standard LCL boxes and drop-and-pull transport are applied to line haul and terminal distribution so that the costs of logistics operation can be reduced, logistics procedures simplified and logistics efficiency and service quality improved.

(3) Logistics facilities cannot fit the characteristics of e-commerce logistics distribution

The existing logistics facilities cannot meet the call of quickness and exactness of e-commerce logistics (Zhang et al., 2009; Xiao et al., 2014). The Improper use of containers also results in repeated operations in the process of logistics. The improvement of logistics facilities can promote the development of logistics, thus enabling logistics to keep pace with the development of e-commerce (Hu et al., 2010).

(4) Low-level integration of cloud platforms and logistics

E-commerce = information dissemination + online transaction + online settlement + logistics delivery = mouse + wheels (Srinivasan et al., 2002; Arnold et al.,2012; Daniluk et al., 2016). The application of the cloud platform should greatly improve the efficiency of logistics. At present, the connection between hardware and software is imperfect and incomplete. This typically results in the low efficiency of logistics (Yang et al., 2017; Lian et al.,2016; Zhe et al., 2014).

Information flow is continuously generated along with the operation of e-commerce. It is an important component of e-commerce projects and e-commerce logistics systems, providing an indispensable basis for the operation, management, decision-making and strategy-making of e-commerce logistics. Therefore, it is crucial to improve the level of integration between the information platform and logistics. Drawing on the DSR idea and based on the traditional e-commerce network platform, this thesis integrates logistics alliances and management systems to create a new cloud platform (see section 3.4).

The collaborative management of e-commerce logistics faces many difficulties, and logistics is of great importance to e-commerce enterprises. The section that follows illustrates the importance of e-commerce logistics in more detail.

5.4.2 The importance of e-commerce logistics

Through the analysis of the above problems, it is concluded that the entire logistics system plays a critical role in e-commerce.

Modern logistics no longer just focuses on the goods transportation from manufacturers to consumers, but takes into full consideration various aspects of logistics, such as goods transportation, warehousing, distribution, packaging, distribution processing, loading and information processing. It does this so that the economic benefit and efficiency of the whole supply chain will be improved overall. Logistics support is indispensable in social production activities, especially in e-commerce activities (Xu et al., 2017; Jiao, 2016). The importance of logistics is illustrated below:

(1) Logistics supports production

Both in a traditional logistics industry and in an e-commerce environment, production is the basis of goods (Hoek, 2013). Production activities are mainly the collection of raw materials in the early stage, as well as the transportation and processing of materials. The entire production process is actually a process of logistics. A sound logistics system can save production costs and lower commodity prices, thus enhancing customer satisfaction with online products (Alchian et al., 1972; Akyelken, 2016). Production without logistics will be difficult and e-commerce will be crippled.

(2) Logistics is the fundamental guarantee to the "customer-oriented" service

The main reason for the innovation of e-commerce is to get rid of the barriers posed by time and place, and to provide consumers with the greatest convenience (Gudehus et al., 2012). E-commerce logistics is of great importance to break time and space barriers. With low logistics efficiency, consumers may receive their goods afterward placing an order after a long period of time, and logistics at this point is meaningless. This will damage customers' confidence in e-commerce. The customers' main concern is whether the goods will be delivered safely and quickly. This is also an important part of e-commerce (Yang et al., 2014).

(3) E-commerce collaborative theory is indispensable to the establishment of a logistics system

The practice of e-commerce collaborative theory is aimed to bridge the gaps in e-commerce and to make an e-commerce operation run smoothly (Xiao et al., 2015). E-commerce should give priority to the construction of logistics because e-commerce without logistics will become meaningless (Hwang, 2002; Holsapple, et al., 2015; Kiani et al., 2015).

The appropriate application of e-commerce logistics collaborative theory thus largely depends on the construction of the logistics system.

(4) The big data platform promotes the development of e-commerce logistics

E-commerce enterprises are aim to be experts in big data processing (Hu, 2018). Customer demands are transformed into figures through background processing and are transmitted to all parties involved in the supply chain. The application of big data platforms will give full play to the strength of the collaborative management of logistics (Gong et al., 2014). The internal management system should be connected to the big data platform. Through the deduction of big data, the routes of the vehicles are calculated, and the reverse logistics are planned. In this way, the efficiency of logistics is improved and all parties involved in the supply chain are better integrated, thus assisting in improving the operational efficiency of e-commerce.

5.5 Summary

Logistics plays a significant role in the collaborative management of e-commerce. In for example section 5.4, the e-commerce logistics collaboration is analysed in detail and the

importance of e-commerce logistics is clarified, which makes it clear the important role of logistics in e-commerce collaborative management. Furthermore, in order to promote the application of e-commerce collaborative theory to the logistics system, several points should be followed:

- First of all, it is necessary to establish a logistics system according to the situations of the enterprise itself: Allocate the logistics nodes in the right places, set more appropriate transportation routes and consider whether the other nodes are self-built or set up with partners based on the conditions of the existing logistics nodes.
- Meanwhile, enterprises should transform their own e-commerce platforms and combine these e-commerce platforms with their own management platforms.
- They should also promote co-operation of vehicles and enhance the management of a vehicle dispatching platform.

- Importantly, they should strengthen warehouse supervision and connect the warehouse monitoring system with the cloud platform.

Based on the analysis of collaborative management of e-commerce logistics in this chapter, the e-commerce logistics system is designed more detail with the help of collaborative theory in the following chapter.

Chapter 6:

Construction of an e-commerce logistics system

Based on the theoretical foundation of logistics collaborative management， this chapter will further improve the construction of an e-commerce collaborative logistics system, reasonably lay out the network hubs. This improves communication in the supply chain, improves transportation efficiency and lowers logistics costs. The case example considered is based on the context of China.

Based on the research questions and research objectives stated in chapter 1, that is, Build an efficient and convenient logistics system based on the e-commerce collaborative theory（see section 1.3 and 1.4）, a logistics system is designed with the guidance of e-commerce collaboration in this chapter. The logistics efficiency will be improved and the logistics risk will be reduced through the standard LCL boxes design and the application of drop-and-pull transport. The logical relationships in e-commerce logistics collaboration are displayed through the DSM in section 3.3 The logistics system is also constructed on that basis.

This chapter introduces the relevant theoretical review of collaborative distribution, builds a radial-spoke logistics network logistics system with the help of collaborative theory, and analyses the main logistics nodes in more detail.

6.1 Collaborative distribution

According to the analysis presented in chapter 5, it can be seen that it is necessary to innovate and develop the existing logistics models by taking all the elements, such as the customers' and enterprises' demands, the characteristics of e-commerce logistics and the actual affecting factors, into account.

This thesis adopts the DSM to demonstrate the logical relationships in e-commerce logistics collaboration (see section 3.3) (Xu, 2002; Zhang et al., 2012; Barkhuizen, 2012; Guenov et al., 2005). The study employs the DSR method, comprehensively considers the characteristics of e-commerce logistics distribution and customer demand, and integrates the collaborative theory to design the radial-spoke logistics system, which reflects the logical relationship of e-commerce logistics collaboration. To achieve this, "collaborative distribution" may be an effective solution to the terminal logistics delivery of current business-to-consumer (B2C) e-commerce in China (Wang et al., 2013).

The logistics collaborative distribution can be illustrated showing that different delivery routes will be integrated based on the logistics characteristics and demands, no matter what kind of logistics modes an enterprise chooses, i.e. self-support or cooperating with third-party enterprises.

Therefore, many deliveries in the same region are integrated into a collaborative distribution network through cooperation and coordination, thus improving logistics efficiency, achieving resources sharing, saving enterprise costs and achieving economies of scale (Yu et al., 2011; Verdonck et al., 2013; Xu et al., 2015).

Collaborative distribution can effectively solve many problems, such as insufficient logistics capacity. In fact, collaborative distribution has been widely applied to terminal logistics delivery and brought great benefits in some countries (Li et al., 2012). At present, the collaboration is typically only applied in the terminal delivery. Based on this, the thesis integrates e-commerce and logistics systems and then designs the whole logistics network and the new drop-and-pull transport equipment. Based on the theory of logistics collaborative management, the research further improves the system construction of e-commerce collaborative logistics in some details, applies the collaborative theory to all aspects of logistics operations, improves the layout of network hubs, and realizes the interconnection and interoperability of supply chains.

However, in view of the status quo of the logistics industry in China, historical factors, and the reality, the model of collaborative distribution has not received effective recognition in China. Therefore, to accelerate its application, the Chinese government and e-commerce and logistics enterprises should work together to break the barriers in the industry and to encourage, with a long-term view of industrial scale, the collaboration among the major enterprises involved in the entire industry to realise a win-win result.

In terms of the above discussion about the design of the e-commerce collaborative theory framework, the four-stage radial-spoke logistics network will be designed to connect the whole supply chain and to promote the collaboration of all parties in the supply chain. Whether the whole logistics system is reasonable or not can directly affect the efficiency of logistics operations and further affect the development of e-commerce. Therefore, a sound logistics system is the key to solving this issue. Next, the construction of a logistics system with the help of collaborative theory will be introduced in more detail.

6.2 Overview of the logistics system

The preceding section has introduced the mode of collaborative distribution suitable for terminal delivery, providing clues for solving the problems in the "last-mile" delivery of e-commerce logistics, designing logistics system, reducing logistics risks, and improving logistics efficiency. In this section, a four-stage radial-spoke logistics system is designed based on the collaborative theory. To solve the problems of scattered transport areas, difficult short-term aggregate transport tasks and hard product quality supervision in the process of logistics transportation，this research attempts to get through the "first mile" and "last mile" delivery with the help of the DSR concept. A more efficient four-stage radial-spoke logistics network is thus designed. so as to provide one-stop transportation and distribution services in China and promote e-commerce across the country.

The four-stage radial-spoke logistics network will be established all around China. The intent in this thesis then is to provide enough evidence for the four-stage radial-spoke logistics network to be established all around China.

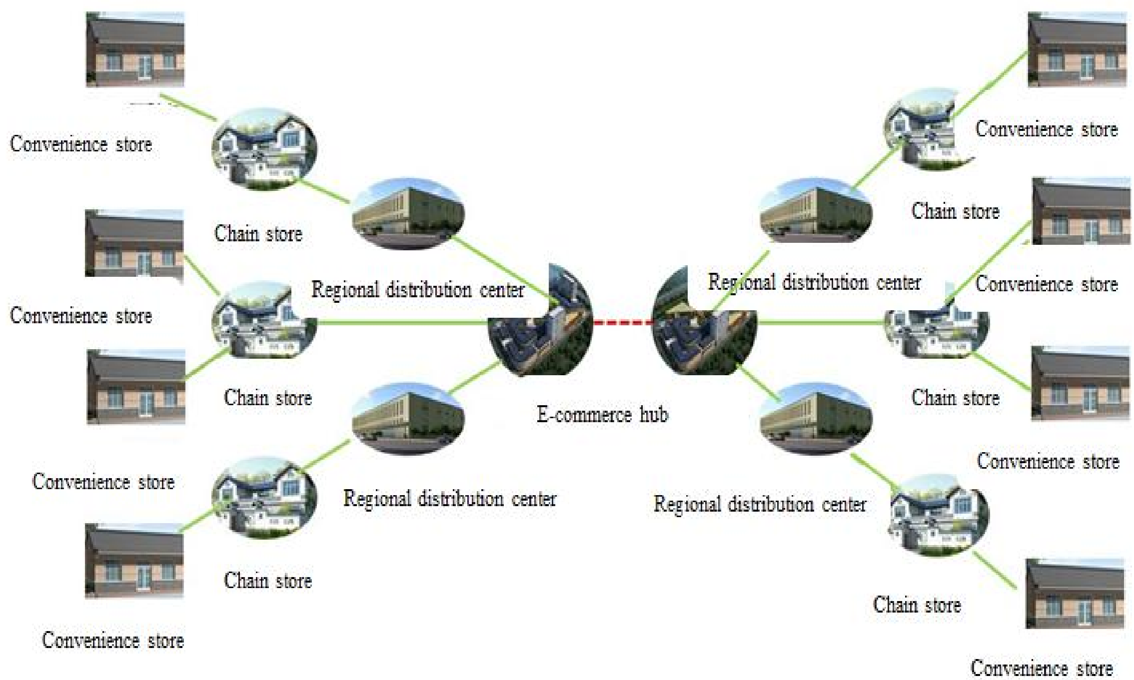
- Firstly, e-commerce cooperatives will be established in rural areas or in communities, e-commerce physical stores at municipal level, e-commerce regional distribution centres in one or two major provinces, and e-commerce hubs in major hub cities across China. During the process, scientific methods and advanced technologies such as Affinity propagation Clustering Algorithm, etc. (Wang et al., 2014; Wang et al., 2013) are employed to design layout for the network hubs, as well as transform corresponding facilities and equipment.

- Secondly, the new standard LCL boxes, which can be divided into three classes, will be designed for drop-and-pull transport. Four kinds of standard LCL boxes of different specifications will be designed as first, second and third class, and loaded in special and specific ways.(See in section 7.1) During the transportation, the application of standard LCL boxes can help to solve the problem of misuse of vehicle space and overloading or under-loading, thus improving sorting efficiency and avoiding repeated sorting.

In the specific operation and implementation of the entire logistics network, once the goods are collected by the source of the supply chain via the terminal nodes, they are dispatched to the e-commerce regional distribution centers through a vehicle dispatching platform. After simple processing in the centres, the goods are loaded in first- or second-level cold-boxes according to the condition of the goods and the order, during which later sorting should be avoided as much as possible and one box for one order is recommended. Then, these boxes are transported to the e-commerce hub by means of drop-and-pull transport. The first-level standard boxes are loaded according to directions, fastened in a special and specific way, and then are transported by line haul to the destination e-commerce hub, where they will be sorted and packed according to customer orders. If sorting or packing is not necessary, they will be shifted directly to another line haul vehicle and transported to the e-commerce regional distribution centers for delivery to major customers (including e-commerce physical stores). As for goods of customers in villages and towns, they will be reloaded in the second- or third-level standard boxes in the centers and transported through LCL to the terminal nodes and the return process is the same as it. Finally, the terminal nodes should achieve a better performance of last-mile delivery.

The construction of the whole logistics system should lay a solid foundation for e-commerce collaboration. Smooth operation of the logistics system will not only improve logistics efficiency, but also save time for e-commerce logistics through collaboration. The concept radial-spoke logistics network is shown as figure 6.1.

Figure 6.1: Radial-spoke logistics network



The preceding section mainly introduced the operation mode of the four-stage radial-spoke logistics network, and the systematic planning of the relevant logistics nodes, namely the e-commerce hub, the e-commerce regional distribution centers, chain stores and convenience stores. This enables the entire transportation network to be collaborative and aims to guarantee the “first-mile” and “last-mile” delivery, thus improving logistics efficiency and service quality. The logical relationship of the collaboration of all logistics nodes is expressed in the form of the DSM (see section 3.3). The main elements of the radial-spoke logistics network will be discussed in more detail in the following sections.

6.3 Layout of e-commerce hubs

The e-commerce hub (The e-commerce hub is shown is figure 6.1) is the centre of the four-stage radial-spoke logistics system, and is designed for the sorting, packing and transit of goods. Therefore, its layout is crucial in the operation of the entire logistics network.(Gupta et al., 2018)

The layout of the e-commerce hub is designed in this section (Lampariello et al., 2015; Wu et al., 2017). E-commerce hubs consist of warehouses, goods sorting centers, etc. An e-commerce hub will be set up at a hub city in China, with the main function of goods storage, sorting and transit.

Firstly, it will be responsible for the sorting of goods transported by line haul to the province. All goods will be dispatched to the e-commerce regional distribution centres in the province through the vehicle dispatching platform.

Secondly, it will be responsible for receiving goods from the e-commerce regional distribution centres, and orders of major customers (including e-commerce physical stores) will be sorted and loaded in standard LCL boxes in the centres in accordance with the detailed information provided by the e-commerce big data cloud platform. Then, the sorting information will be uploaded to the cloud platform and the goods will be transported to every part of China through a national trunk network. It will also be responsible for the storage of the goods.

6.4 E-commerce regional distribution centers

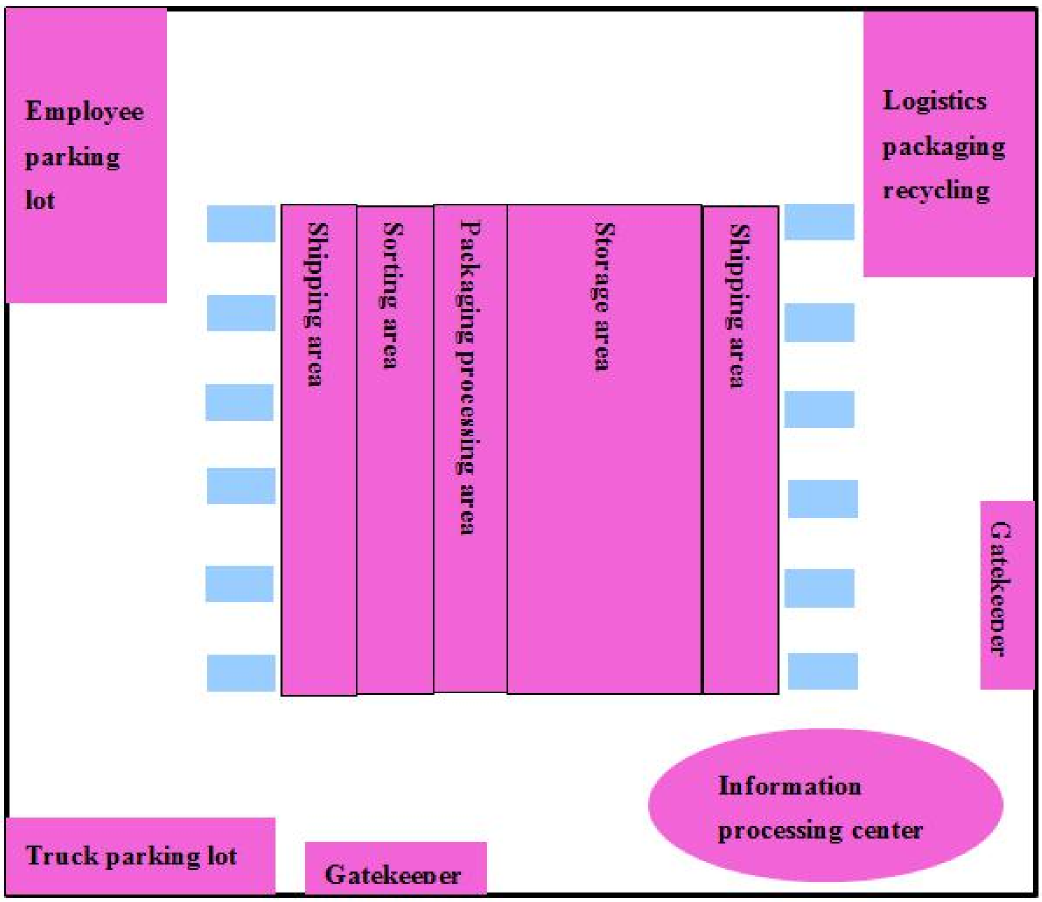
The previous section introduced the e-commerce hub. The e-commerce regional distribution centres should collaborate with the hub to finish the sorting, transportation and rough processing of the upstream goods (Zhang et al., 2010; Li et al., 2013; Wang et al., 2014).

This section will introduce the functional areas and major businesses of the e-commerce regional distribution centres in more detail. E-commerce regional distribution centres consist of warehouses, goods sorting centres and rough processing areas (Oum et al., 2004).

It is necessary to establish the e-commerce regional distribution centres in one or two provinces with the major functions of rough processing, as well as the storage of upstream goods, the sorting of rough-processed goods and vehicles dispatching (Weißhuhn et al., 2017).

On the one hand, the unprocessed parts of agricultural products, meat and other goods transported from the e-commerce physical stores are initially processed in the primary processing area, adding their additional value. On the other hand, the centre is to receive the goods from the e-commerce physical stores and the corresponding e-commerce hubs, and organise the vehicles to transport by line haul or feeder transportation the standard LCL boxes containing the goods to the e-commerce hubs and the e-commerce physical stores (Ren, 2017). The conceptual warehouse layout of e-commerce distribution centers is shown as figure 6.2

Figure 6.2 Warehouse layout of e-commerce distribution centers



6.4.1 Internal functional areas of e-commerce regional distribution centers

The e-commerce regional distribution centre includes a goods transportation area, warehousing service area, distribution processing area and logistics information service area. This section will introduce the main functions of each area separately (see figure 6.2).

(1) Goods transportation area

Goods line haul transportation area:

This area is mainly responsible for receiving goods transported from the e-commerce hubs.

Area for terminal delivery of goods in the region:

This area is responsible for the unpacking and classification of goods and for transporting them to e-commerce physical stores or e-commerce cooperatives (Zhang et al., 2015; Krejci et al., 2015; Mohamed et al.,2010).

(2) Warehousing service area

This area is mainly responsible for the storage of goods and for simple classification.(Lei et al., 2018)

(3) Distribution processing area (only in the regional distribution centers)

This area is responsible for the simple packaging of goods, if necessary, increasing the additional value of the goods (Jarrett, 2016).

(4) Logistics information service area

With the function of the logistics information system, the logistics efficiency can be improved. Information about goods can be provided to customers in time and the quality of logistics services can be improved (Xu, 2015; Hu et al., 2014; Michelberger et al., 2013).

6.4.2 Major business of e-commerce regional distribution centres

The major business of the e-commerce regional distribution centres is basic distribution processing and warehousing services for primary agricultural products, as well as road transportation and loading (Bandrauk et al., 2004; Li et al., 2013; Bo et al., 2010):

(1) Distribution processing

Distribution processing of products is regarded as one of the important functions of the distribution centres. Distribution processing, the intermediate link between production and consumption, is conducive to the integration of production, supply and marketing of agricultural products.(Long et al., 2016)

The contents of product distribution processing mainly include the following
(Wu et al., 2014; Wei et al., 2015; Feng et al., 2016):

Freezing processing: For preservation and shipment, as well as the loading of fresh meat in circulation, deep freezing is used.

Sorting processing: The dispersion of agricultural and sideline products is relatively large. In order to obtain products of certain specifications, the products are processed by manual or mechanical sorting, such as the sorting of fruits and the melons (Plewa et al., 2015).

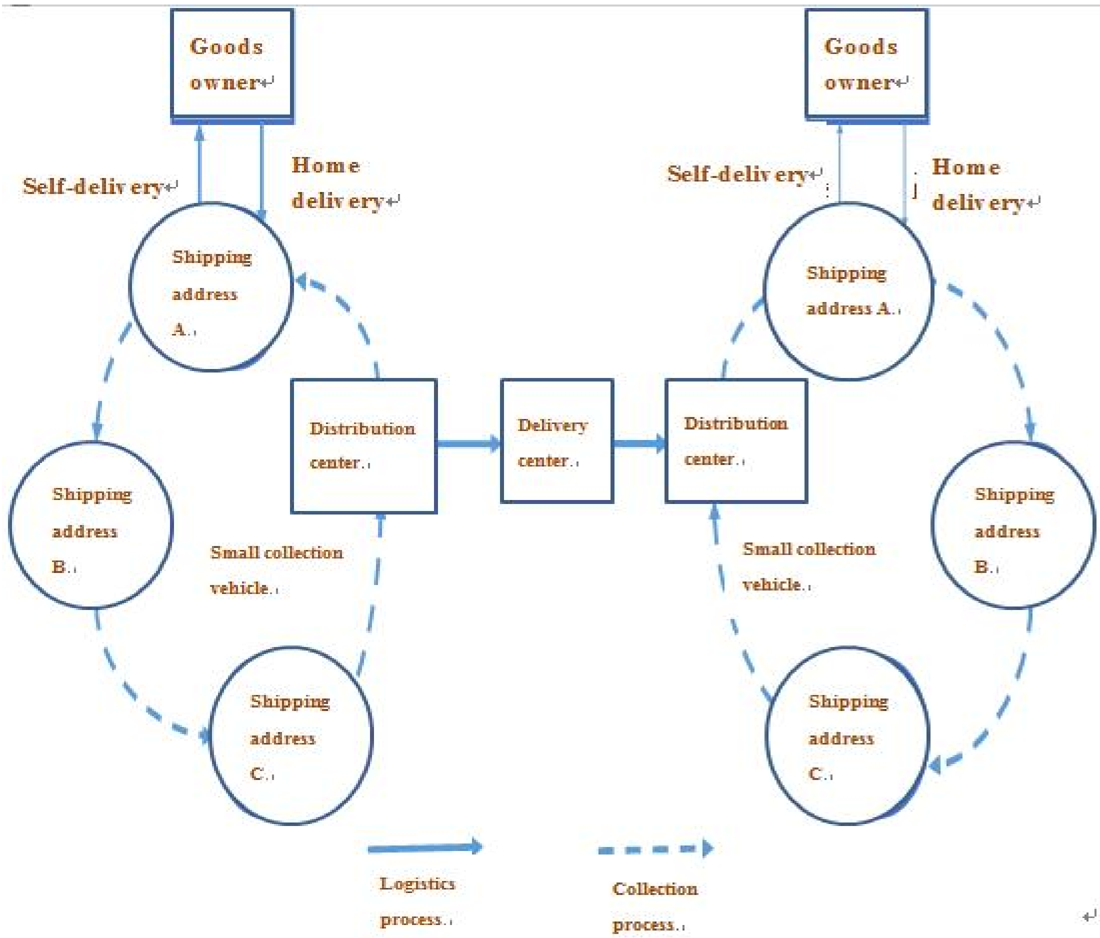
Packaging processing: To satisfy the consumers' requirements for different packaging specifications, large packaged goods should be changed into small packaged ones (Sheng et al., 2013).

(2) Road freight loading and transit

The road freight loading service is to collect scattered small-batch goods to the loading centre of hubs, combine them into batches based on different transport routes and then use large vehicles to serve the inter-area line haul transportation needs (Yan et al., 2011).

After the goods arrive at the destination loading centre, the large vehicles are replaced by smaller vehicles suitable for city transportation to complete the terminal delivery of the goods (Huang, 2016). The process of highway freight transportation is shown as figure 6.3

Figure 6.3: The process of highway freight transportation

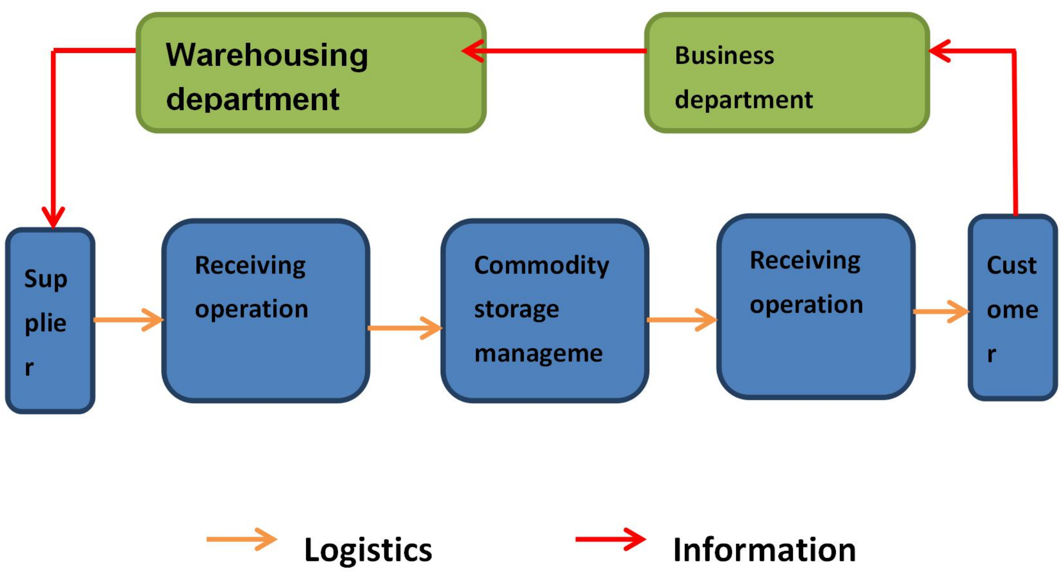


(3) Warehousing services

Warehousing is an important function of regional distribution centres. Warehousing services operations include warehousing area ex-warehouse and inventory management (Issa et al., 2016). The warehouse operators of the hubs and the regional distribution centres are entrusted by the goods owners to carry out the tally business, a kind of logistics activities, such as goods storage, warehousing and ex-warehouse, and to provide value-added services like inventory management (Jane et al., 2006; Li et al., 2013; Santibanez et al., 2016). The storage service process is shown as figure 6.4.

As an important part of logistics services, warehousing service is the bond between the front-end e-commerce enterprise and the back-end consumers. It plays the role of stocking and ensures the effective circulation of goods. The DRS method is employed in this section to design the warehousing service process from the suppliers to the customers by fully integrating logistics and information flow (Miao et al., 2016). This endeavor aims to improve the logistics operational efficiency of the regional distribution centres.

Figure 6.4: Storage service process

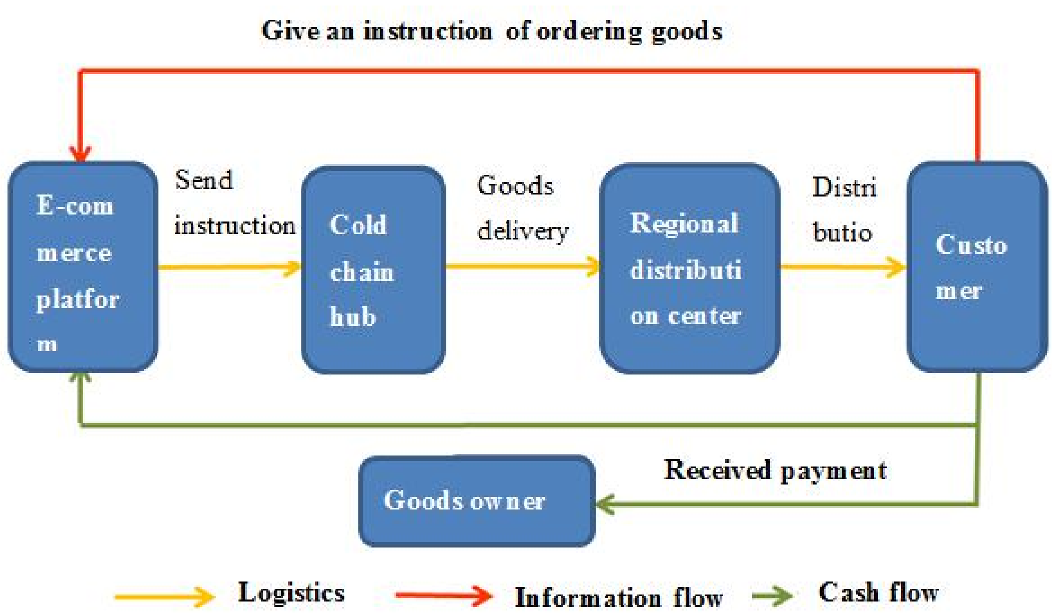


(1) E-commerce logistics services

E-commerce logistics services give support to e-commerce. For example, it provides services such as warehousing, distribution and payment for e-commerce enterprises (Zhao et al., 2010; Hua et al., 2015; Hsiao et al., 2017). The e-commerce logistics business process is shown in figure 6.5.

The DSR method is employed to the warehousing service process from the suppliers to the customers by considering the collaborative relationship between e-commerce and logistics and integrating logistics, information flow and capital flow.

Figure 6.5: Logistics flow chart of e-commerce business



This section introduced the functional areas and business processes of the e-commerce regional distribution centres. The next section will introduce the next stage of the four-stage logistics network, namely e-commerce physical stores.

6.5 E-commerce physical stores

The e-commerce physical stores will be located at the city level. Initially, it will receive the goods from the e-commerce regional distribution centres, then distribute the e-commerce goods to the villages and communities through crowdsourcing logistics. This refers to the fact that the enterprise transfers the distribution work originally undertaken by the employees to the masses outside the enterprise (Mladenow et al., 2015). In view of the difficulties in optimising logistics terminal distribution and the problem of high cost and low efficiency, the DSR method is employed to utilise the new generation of "Internet plus logistics" technology and the crowdsourcing logistics mode to integrate idle transport resources, thereby solving the problems in the last mile delivery. Finally, the e-commerce physical stores help to complete the last-mile delivery of e-commerce goods (Panda et al., 2015). The main functions of the e-commerce physical stores are as follows:

(1) Goods distribution

Large and medium-sized farmer households can transport their own agricultural products to the e-commerce physical stores, where preliminary quality inspections are conducted (Tardif et al., 2010). Then, agricultural products are graded according to quality, payment is settled and product information is uploaded to the e-commerce big data platform (Cedomir et al., 2012; Simi et al., 2012).

(2) Goods delivery

e-commerce physical stores are responsible for distributing goods to e-commerce cooperatives by crowdsourcing logistics or self-built distribution systems. This will promote the implementation of e-commerce logistics in rural areas. Moreover, ordinary express delivery, goods consignment and other services can be covered to enhance the competitiveness of e-commerce physical stores (Montoya et al., 2016).

(3) Standard LCL boxes recycling

For urban goods distribution, the standard LCL boxes designed through this study can help to reduce sorting times and improve operational efficiency. Therefore, standard LCL boxes should be recycled in the e-commerce physical stores (Coelho et al., 2011; Birrry et al., 2016). Of course, the vehicle dispatching platform conducts the optimisation of delivery, whereby standard LCL boxes are loaded and transported directly by vehicles to the nearest e-commerce physical stores or e-commerce convenience stores for reloading and distribution.

This section introduced three functions of e-commerce physical stores. The following part will introduce the fourth stage of the logistics network, namely the e-commerce cooperatives. The cooperatives are also the terminal nodes of the entire logistics network.

6.6 E-commerce cooperatives

E-commerce cooperatives consist of urban community cooperatives and rural e-commerce cooperatives that connect all nodes of the logistics network. The establishment of e-commerce cooperatives should cooperate with convenience stores in rural areas and communities (Yuan et al., 2015; Wei et al., 2014; Jun et al., 2015). With the cooperatives as the terminal nodes established, a four-stage logistics network takes shape.

As the last-mile (terminal) service nodes of the supply chain network, the establishment of e-commerce cooperatives mainly depends on the cooperation of urban communities and rural convenience stores. E-commerce cooperatives play an important role in terminal delivery (Jiao, 2016). This section will introduce the operation modes and major business of e-commerce cooperatives and introduce the major business of urban community cooperatives and rural e-commerce cooperatives respectively.

6.6.1 Operation modes of e-commerce cooperatives

E-commerce cooperative is an emerging terminal distribution model based on e-commerce and joint distribution. It can be set up by third-party logistics enterprises or e-commerce enterprises. These business stores are equipped with specific deliverymen and facilities for distribution, and they also provide terminal personalised delivery services (Song et al., 2014).

On the one hand, through the cooperation agreement with the express and logistics enterprises, the deliverymen of the stores are responsible for door-to-door delivery. The stores will charge the enterprises with goods to be delivered, i.e. certain service fees according to the type and weight of the delivered goods. The logistics enterprises will quickly complete the delivery of goods through outsourcing to terminal distribution business (Dong et al., 2012).

On the other hand, these stores can also cooperate with e-commerce enterprises that will provide warehousing, distribution, cash on delivery. and other services (Kong, 2015). After a customer places an order, the delivery personnel will collect the goods at the warehouse. After collection and sorting in the distribution centres, the goods will be sent to all stores for distribution. This operation mode avoids the delivery of express enterprises, that is, transport only by e-commerce cooperatives, and delivers the goods to customers with quickness and exactness. However, this operation mode requires a long history of development and strong financial support to ensure operational continuity. Therefore, the mode of relying on third-party logistics enterprises or e-commerce enterprises is mainly used at present (Chen et al., 2015).

6.6.2 Major functions of e-commerce cooperatives

In the current distribution network, e-commerce hubs, regional distribution centres, e-commerce physical stores and e-commerce cooperatives perform their duties and communicate through information platforms (Yu et al., 2016; Bai, 2017). E-commerce cooperatives at the end of the distribution network are responsible for the terminal delivery (Liu, 2013). The services and functions of the e-commerce cooperatives are as follows:

(1) Distribution

The goods are uniformly sent to the e-commerce cooperatives by the hubs or the regional distribution centres for secondary distribution. E-commerce cooperatives are usually located in neighborhoods close to terminal customers. Through scientific or fundamental calculation (Jun et al., 2015; Wei et al., 2014), the optimal service radius of the terminal joint distribution network is obtained, and each cooperative is responsible for delivery within its business scope. Walking, bicycles, and energy-saving or environmental-friendly electric vehicles can be used for secondary distribution (Zhang et al., 2017).

(2) Self pick-up

If customers choose to pick up the goods themselves, they can select the cooperatives through the e-commerce platform when placing an order. The distribution centres or the logistics chain will then send their goods directly to the designated cooperative and send the notification through the platform for the convenience of customers to collect the goods on their way to or from work (Yang, 2016).

(3) Return of goods

There are two modes for customers to return goods. One is that the cooperatives send their staff to the customers' residence or workplace to collect the goods. (Customers contact with the nearest cooperative or the distribution enterprise that will automatically match the nearest cooperative). The other is that the customers take the goods to any one of the cooperatives that is responsible for the return processing (Wang et al., 2017). In the event of an incorrect delivery or delivery failure, the goods can be transferred between different cooperatives without being returned to the hub or distribution centers.

(4) Expanded business

In addition to distribution, self pick-up, return of goods and network functions, e-commerce cooperatives can also provide services unavailable in conventional distribution modes, such as collecting goods or paying for goods, time-limited delivery, fresh food storage and distribution, and point-to-point designated delivery (C2C distribution) (Chen, 2017).

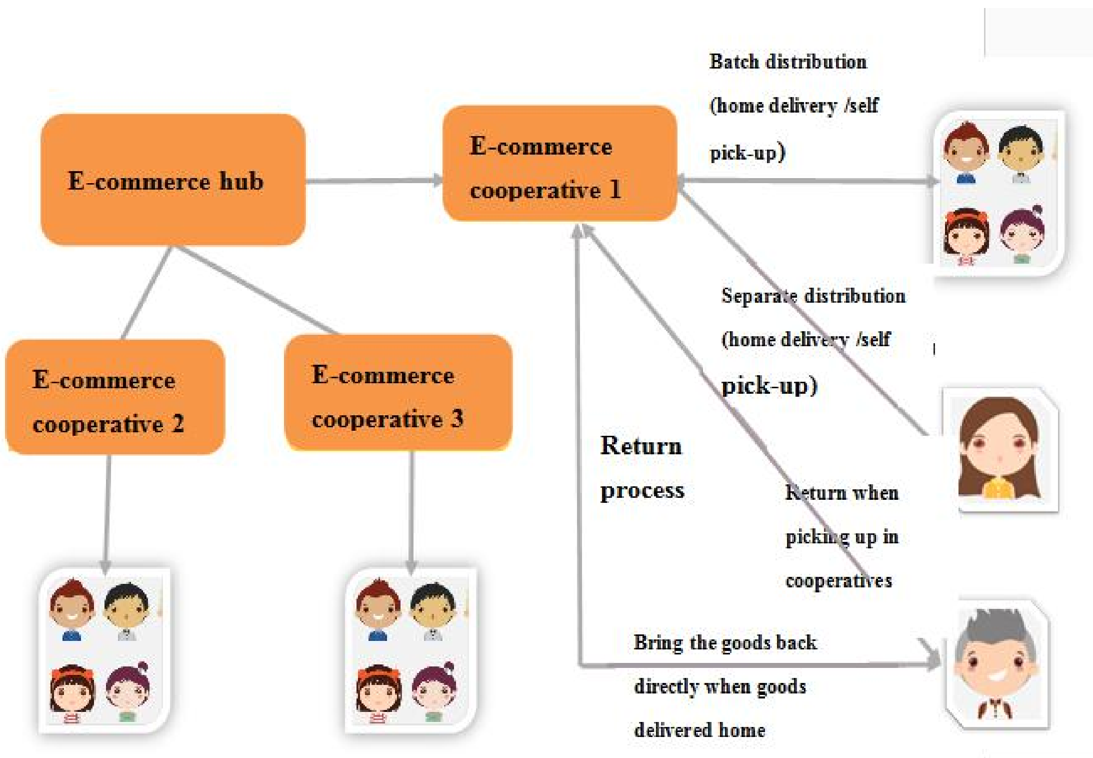
Batch distribution is a way of distribution of e-commerce cooperatives, i.e. a certain number of adjacent apartment buildings are regarded as one area where e-commerce cooperatives deliver goods at a fixed time or customers collect goods themselves (Zeng, 2014). This mode can save human and material resources and allow customers to prepare for signing for goods at a fixed time.

Another mode is to deliver the goods separately for different customers, i.e. delivery as long as there is an order. This mode helps to improve customer service satisfaction, but at a higher cost. The biggest advantage of using e-commerce cooperatives for terminal distribution is reflected in the return business (Zhang et al., 2012).

When the customer is dissatisfied with the goods, the e-commerce cooperatives can directly return the goods. This will not only save the customer's time, but also save logistics costs of return business. The returned goods will be sent directly back to the distribution centres or hubs with the next delivery vehicle. The delivery time and quantity of goods of e-commerce cooperatives can be coordinated through the distribution centres, hubs and the logistics information platform

(Heeswijk et al., 2015). Timely and effective communication of information enables both parties to prepare for the delivery and receiving of goods. The delivery process of logistics cooperatives is shown as figure 6.6.

Figure 6.6: Delivery process of logistics cooperatives



6.6.3 Urban community cooperatives

Community convenience stores can be seen in most of the daily consumption areas of most urban residents. As terminal nodes of the last-mile delivery of e-commerce logistics, they can not only shorten the distance to consumers, but also improve the efficiency of e-commerce collaboration (Zhang et al., 2012).

(1) Convenience store service

Community convenience stores are small shopping places providing convenient and quick shopping services in order to meet the emergency consumption demands of residents in the community (Chen, 2010). As a bridge between the entire supply chain and consumers, the shopping service of the convenience stores is necessary to maintain customer contact (Chang et al., 2010).

(2) E-commerce goods distribution

Usually, convenience stores are at the entrance of the residential area or someplace with convenient transportation and a high flow of customers. So taking these places as the terminal nodes of e-commerce goods distribution, whether it be customer self pick-up or door-to-door delivery, will provide great convenience for consumers and increase sales (Wang, 2017).

6.6.4 Rural e-commerce cooperatives

Rural e-commerce cooperatives penetrate into the rural interior, which not only satisfies the demands of customers in rural areas, but also provides convenient channels for the integration and selling of agricultural products.

(1) Integration of agricultural resources

The e-commerce definitely involves the sales of agricultural products. Therefore, the establishment of rural e-commerce cooperatives provides convenience for the first-mile purchasing and resources integration of the e-commerce supply chain (Miao et al., 2011; Jian et al., 2015; Tan et al., 2014). Agricultural products are sold throughout China through the e-commerce big data platform and human resources. The new contribution of the thesis here is based on the e-commerce big platform to integrate e-commerce and logistics systems and then design the whole logistics network and apply the new drop-and-pull transport equipment. The improvement of the big data platform not only better realizes the application of collaborative theory, but also promotes the interconnection and interoperability of all parties involved in the supply chain. Compared to the traditional network platform of e-commerce, this platform realizes the interconnection of multiple interfaces and integrates multiple functions on the network platform, thus avoiding multi-party operation and the phenomenon of “information islands”, which is an efficient and convenient new information service platform.

(2) Logistics terminal nodes

With the rapid development of the economy and the improvement of the quality of farmers' lives in China, buying fresh food online has become more and more popular in rural areas. Therefore, the first-mile delivery of agricultural products is no doubt important. However, rural e-commerce cooperatives, with the establishment of e-commerce logistics network, should also lay great emphasis on last-mile delivery for terminal consumers (Jalali et al., 2011).

(3) E-commerce service

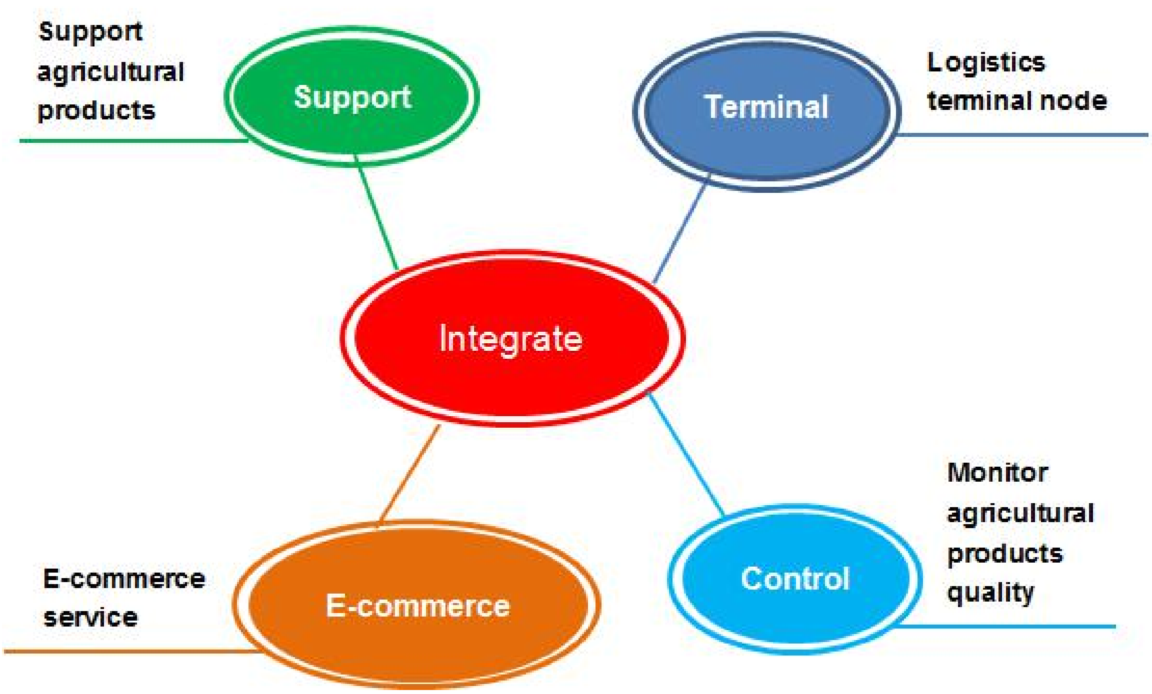
The cooperative will provide value-added services, such as online procurement services, express delivery and recharge. That is to mean that it provides channels for paying the phone bill. It will encourage farmers to make better use of the internet, which not only promotes the sale of agricultural products, but also satisfies the farmers' demands for more materials and diversifies their lives (Chang et al., 2015).

(4) Supporting agricultural products

In order to increase farmers' income, e-commerce cooperatives will provide farmers with scientific cultivation methods in the planting season. In the harvest season, the e-commerce cooperatives will assist by collecting the agricultural products that the e-commerce enterprises have ordered through contracts, and deliver it from the source (Huang et al., 2011).

On the one hand, it solves the problems of labour shortage, transportation tools shortage and low operational efficiency in the harvest season. On the other hand, it sets up a long-term cooperative relationship between e-commerce enterprises and farmers, laying a solid foundation for cooperation in the future (Miao et al., 2011). Rural e-commerce cooperative businesses are shown as 6.7.

Figure 6.7: Rural e-commerce cooperative businesses



6.7 Summary

What is set out above relates to the construction of the whole e-commerce logistics system (see section 6.2). The entire distribution process of e-commerce goods is completed through the work of e-commerce hubs, e-commerce regional distribution centres, e-commerce physical stores and e-commerce cooperatives. The industrial resources are efficiently integrated, the supply chain throughout the entire e-commerce is established and the core requirements for logistics distribution of “convenience”, “high efficiency” and “low cost” is satisfied, laying a solid foundation for e-commerce collaboration.

The radial-spoke logistics distribution network will create scale economies effect through the centralised transportation of products and goods. This is more cost-effective than other types of urban logistics distribution networks

Simultaneously, in the construction of the radial-spoke urban logistics distribution network, the construction of logistics distribution nodes and delivery routes is also in line with the intensified, lean and highly efficient development of cities.

Collaborative managers are mainly the government, enterprises and business management departments of network systems.

If the distribution network optimisation scheme designed through this study is put into practice, problems will be exposed. For example, in the specific implementation, one problem is how to improve the scheme when force majeure such as natural disasters occurs. With continuous improvement, the construction of an urban delivery network will become more and more advanced, which will play a significant role in promoting the development of livelihood and economy in China.

Based on the collaborative management of e-commerce and e-commerce logistics, this chapter focused on the further improvement of the e-commerce collaborative logistics system construction and the establishment of the four-stage radial-spoke logistics system. The next chapter will discuss the improvement of facilities and equipment in the logistics network. To be specific, it attempts to suggest improvement through the design of standard LCL boxes and the introduction of drop-and-pull transport with the aim to improve the utilisation rate of standard LCL boxes and promote the application of LCL boxes in drop-and-pull transport.

Chapter 7:

Drop-and-pull transport and LCL transport in logistics

Based on the collaborative management of e-commerce and e-commerce logistics, the previous chapter focused on the further improvement of the e-commerce collaborative logistics system construction and the establishment of the four-stage radial-spoke logistics system. But apart from the requirement for an appropriate logistics network with good quality and reliability in the transportation of e-commerce products, improvements in facilities and equipment are also required (Cattell, 2002; Liu, 2014; Shuai et al., 2015). Therefore, in what follows in this chapter, the simulation method and DSR are adopted to study the research questions of the design of standard LCL box (see in section 1.3.4) and the application of drop-and-pull transport mentioned in section in 1.4.3. The innovative point is that conventional containers are differentiated and divided into four-stage standard containers suitable for division, loading and unloading that is convenient for the transportation of goods.

7.1 Design of standard LCL boxes

The size design of standard LCL boxes and the shape design of standard LCL boxes are completed in this section. Meanwhile, with the help of simulation method, the volume utilisation ratio and weight loss rate of standard LCL boxes of four design schemes are respectively calculated. Based on the calculation results, the most efficient loading scheme is obtained and the preferred transportation strategy is given (Zio, 2014; Ma, 2017).

7.1.1 The size design of standard LCL boxes

In order to avoid excessive sorting and the disconnected transportation of goods at the logistics nodes, the design idea behind 40-foot standard containers is drawn on and four series of standard LCL boxes set out in table 7.1. It is an effective connection according to the size of the transport vehicle, as well as the basis of standard logistics equipment.

Table 7.1: Four design schemes for standard LCL boxes

	First-stage standard box	Second-stage large standard box	Second-stage small standard box	Third-stage standard box
Scheme one				
External dimensions (m)	2.4*2*2.6	2*1.2*2.6	1.2*1*2.6	0.6*0.4*0.87
Internal dimensions (m)	2.24*1.84*2.3	1.84*1.04*2.3	1.04*0.84*2.3	0.55*0.35*0.82
Scheme two				
External dimensions (m)	2.4*2*2.6	2*1.2*2.6	1.2*1*1.3	0.6*0.4*0.87
Internal dimensions (m)	2.24*1.84*2.3	1.84*1.04*2.3	1.04*0.84*1	0.55*0.35*0.82

Scheme three				
External dimensions (m)	2.4*2*2.4	2*1.2*2.4	1.2*1*1.2	0.6*0.4*0.8
Internal dimensions (m)	2.24*1.84*2.1	1.84*1.04*2.1	1.04*0.84*0.9	0.55*0.35*0.75
Scheme four				
External dimensions (m)	2.4*2*2.4	2*1.2*2.4	1.2*1*2.4	0.6*0.4*0.8
Internal size (m)	2.24*1.84*2.1	1.84*1.04*2.1	1.04*0.84*2.1	0.55*0.35*0.75

7.1.2 Calculation of the space utilisation ratio of standard boxes

(1) Standard box volume utilisation ratio

Investigation has revealed that the carrying capacity of low-bed semi-trailer vehicles for line haul transportation is 30 000 kg (Zhao 2017; Zong et al., 2014). It has also been found that the empty weights of the first-stage standard box, the second-stage large standard box, the second-stage small standard box and the third-stage standard box are 800 kg, 450 kg, 220 kg and 10 kg respectively (Li, 2012). In addition, there are approximately 13 kinds of logistics packing boxes and the data of them is from the Chinese logistics Industry Association in 2015 Their specifications are shown in table 7.2.

Table 7.2: Goods packing boxes specifications

Specification	No.1	No.2	No.3	No.4	No.5
Size(mm)	530*290*370	530*230*290	430*210*270	350*190*230	290*170*190
Specification	No.6	No.7	No.8	No.9	No.10
Size(mm)	260*150*180	230*130*160	210*110*140	195*105*135	175*95*115
Specification	No.11	No.12	No.13		
Size(mm)	145*85*105	130*80*90	110*70*70		

There are more or less 13 kinds of woven mesh bags of different specifications for loading goods, as can be seen in table 7.3. The data of these woven mesh boxes is from the Chinese logistics Industry Association in 2015.

There are roughly 15 specifications of woven mesh bags, namely:

Table 7.3: Specifications of woven mesh bags

15 specifications of woven mesh bags			
40cm*70cm	45cm*75cm	40cm*80cm	55cm*85cm
60cm*85cm	65cm*85cm	53cm*90cm	60cm*90cm
50cm*80cm	52cm*83cm	52cm*85cm	50cm*80cm
60cm*90cm	65cm*90cm	70cm*90cm	

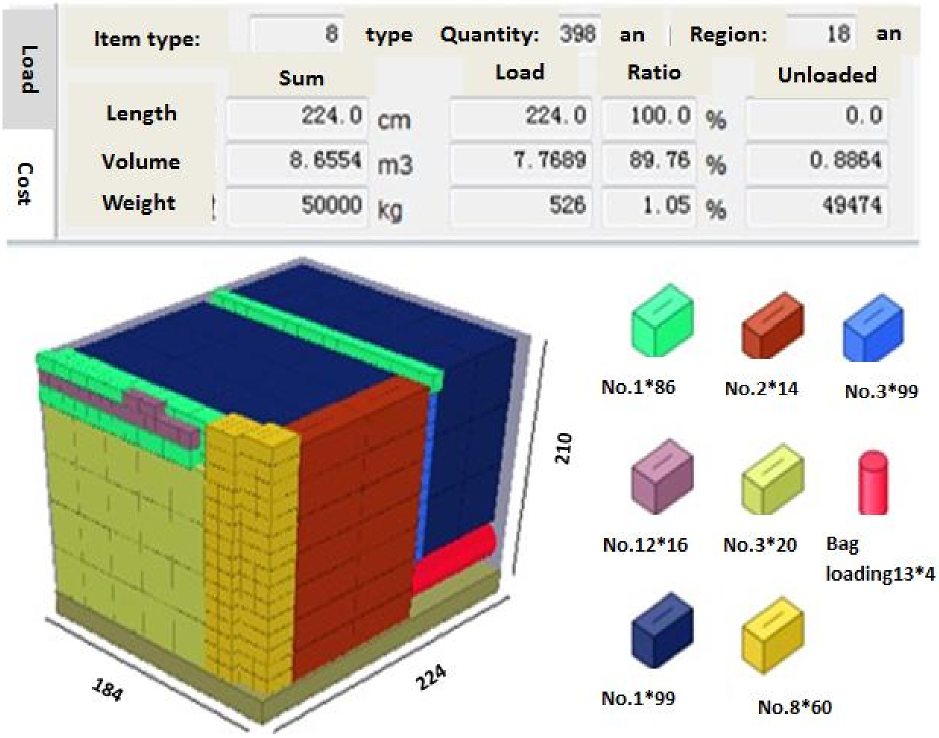
A cargo Simulated loading test of the standard boxes was conducted, on the assumption that the goods loaded in the packing boxes and mesh bags of the above 13 specifications are to be transported. Since overweight seldom occurs in the case of e-commerce transport, the volume utilization ratio is simulated.

Autoload 10.0 is a piece of Chinese loading simulation software. It can simulate the loading of containers to find the best way to load, and it can also be used as the software to evaluate the loading efficiency of containers. It is particularly effective in the analyzing of volume utilization ratio (Zhao, 2015).

The results of the simulation experiment conducted as part of the research in this thesis are as follows:

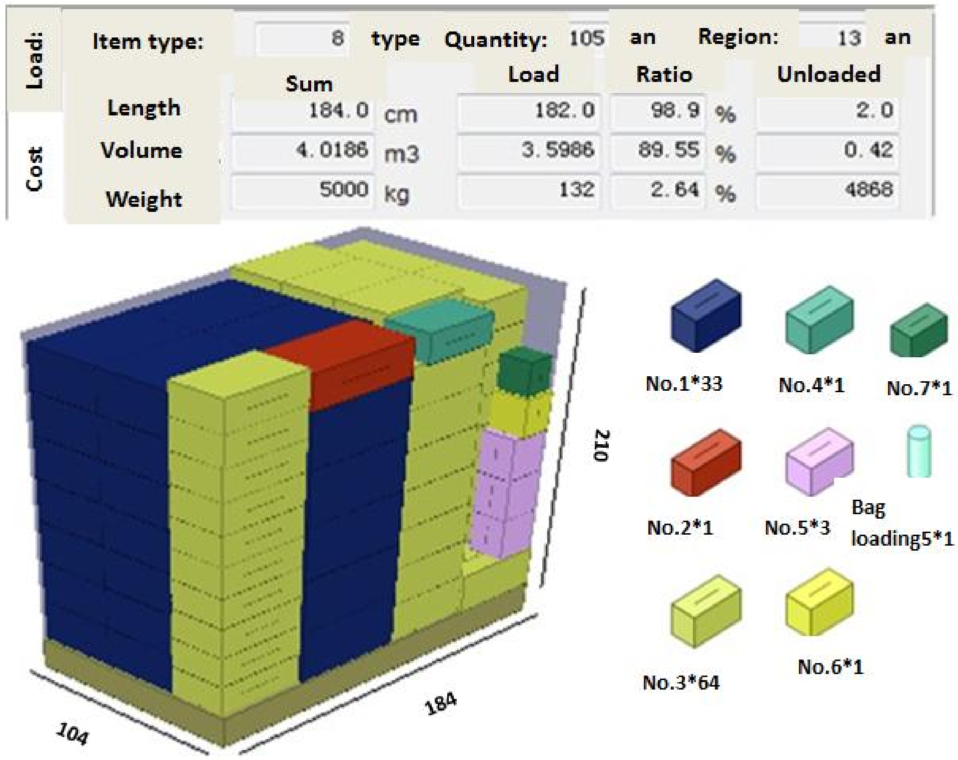
① It is concluded from figure 7.1 that the volume utilisation ratio of the first-stage standard box with the size of 2.24*1.84*2.3 is: 7.7689/8.6554= 89.76%

Figure 7.1: Volume utilisation ratio of first-stage standard box



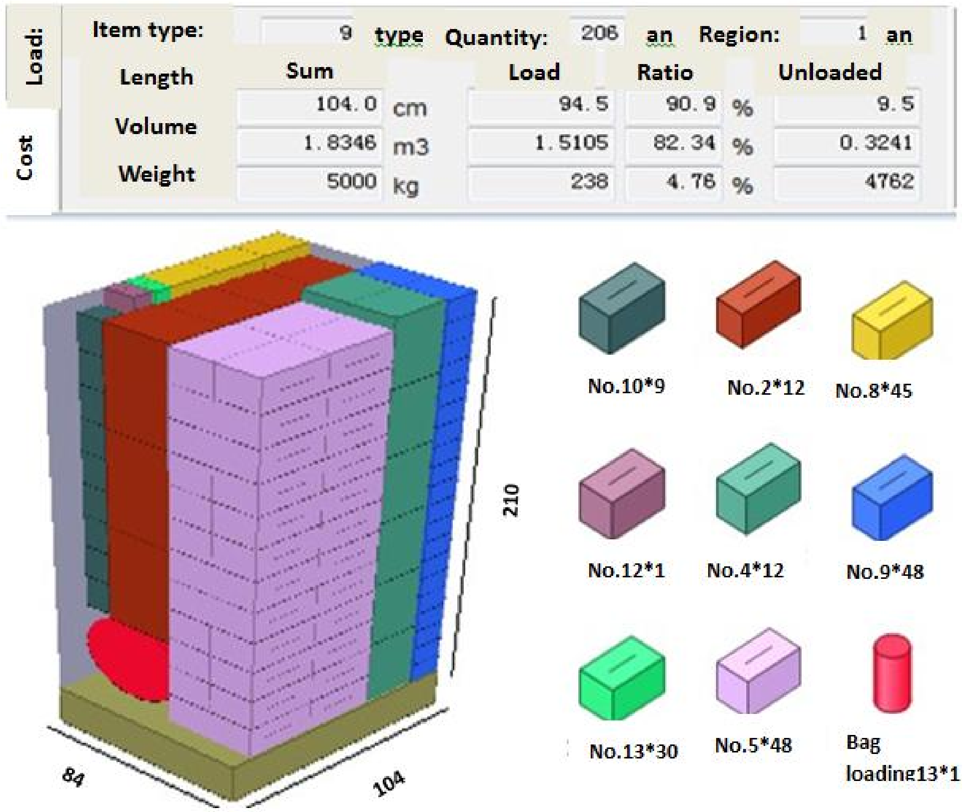
② Concluded from figure 7.2: the volume utilisation ratio of the second-stage large standard box with the size of 1.84*1.04*2.3 is 3.5986/4.0186=89.55%.

Figure 7.2: Volume utilisation ratio of the second-stage large standard box



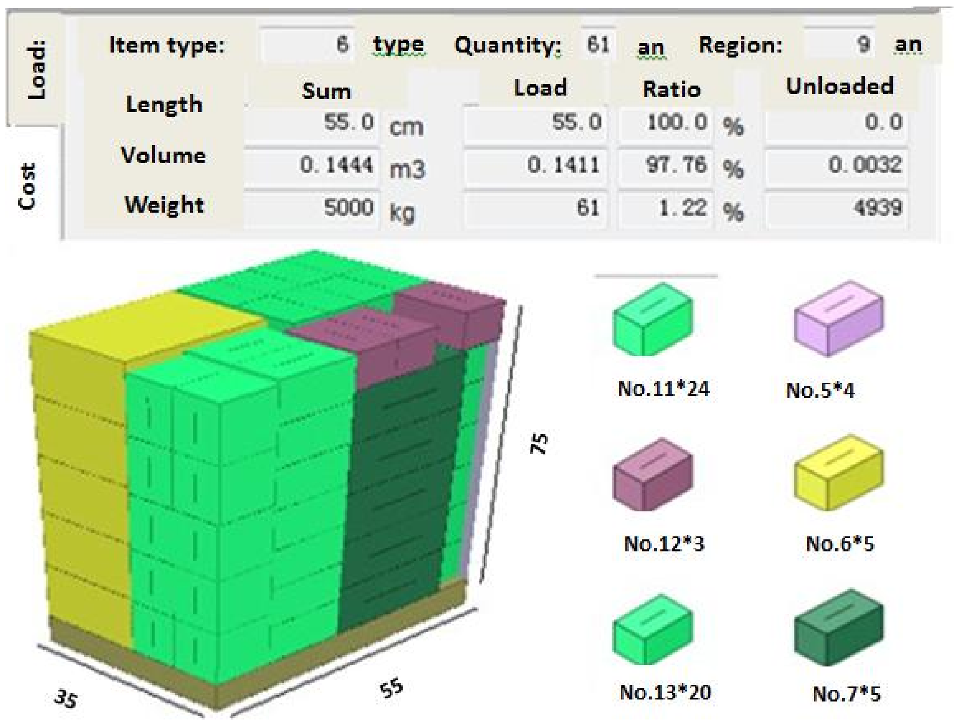
③ Concluded from figure 7.3: the volume utilisation ratio of the second-stage small standard box with the size of 1.84*1.04*2.3 is 1.5105/1.8346=82.34%.

Figure 7.3: Volume utilisation ratio of the second-stage small standard box



④ Concluded from figure 7.4: the volume utilisation ratio of the third-stage standard box with the size of 0.55*0.35*0.82 is 0.1411/0.1444=97.76%.

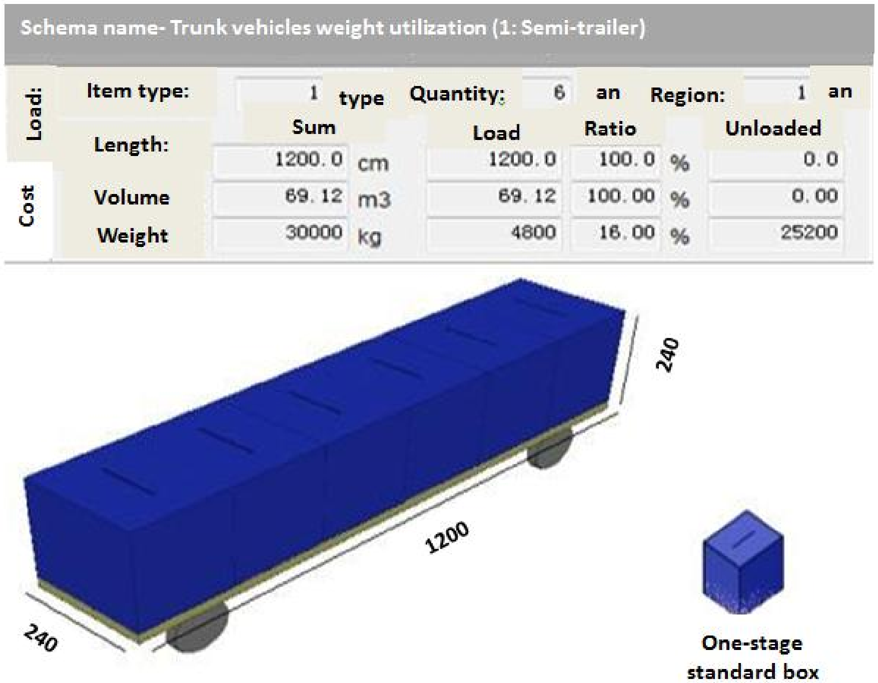
Figure 7.4: Volume utilisation ratio of third-stage standard box



(2) Weight-loss rate of cold boxes

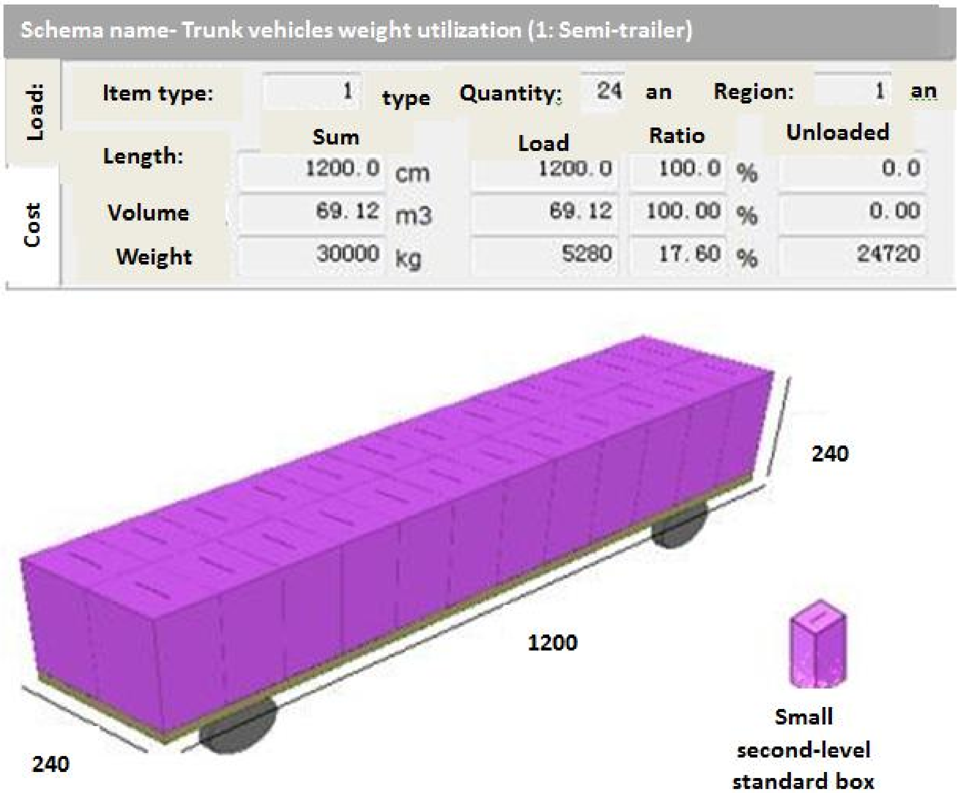
① According to the carrying capacity of the line haul transportation and the empty weights of the first-stage standard box mentioned in section 7.1.2, when first-stage standard boxes are used for line haul transportation, every vehicle has the capacity for six first-stage standard boxes, namely, goods with a capacity of 25 200 kg and the loss of 4 800 kg carrying capacity. Therefore, the weight-loss rate of cold boxes of the first-stage standard boxes is 4800/30000=16%.

Figure 7.5: Loading rate of the first-stage standard box



② When second-stage small standard boxes are used for line haul transportation, every vehicle has the capacity to carry 24 second-stage small standard boxes, namely, goods with a capacity of 24 720 kg with the loss of carrying capacity of 5 280 kg. Therefore, the weight-loss rate of cold boxes of the first-stage standard boxes is 5280/30000=17.6%

Figure 7.6: Loading rate of the second-stage small standard box

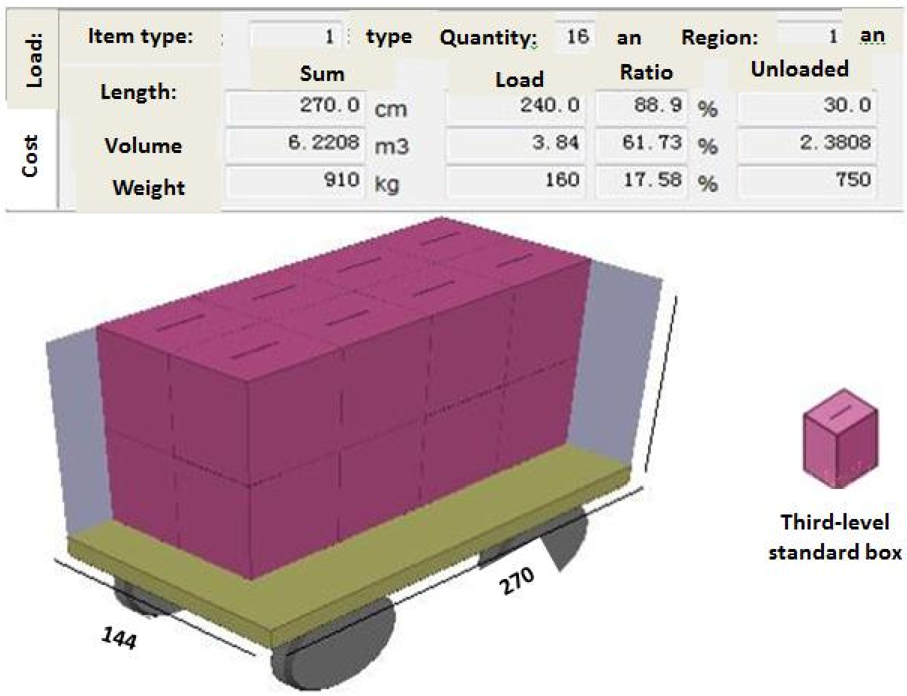


Meanwhile, the first-stage standard boxes, second-stage large boxes and second-stage small standard boxes can be mix-loaded, with a carrying capacity of 24 720 kg to 25 200 kg and the loss of carrying capacity of 4 800 kg to 5 280 kg from the above simulation results.

③ Rate of carrying capacity loss in terminal distribution. For the terminal distribution for small customers， due to the wide variety of goods and the scattered distribution areas, logistics enterprises usually take risks of longer delivery time and excessive logistics costs. While the crowdsourcing logistics mode with the new generation of “Internet Plus Logistics” technology can make full use of local idle resources, reduce logistics costs, improve logistics network, increase distribution efficiency, and help to solve problems in the optimization of terminal distribution (Paloheimo et al.,2015; Robbie et al.,2013). Therefore, the crowdsourcing logistics mode and mini-vehicles will be used for distribution. The loading capacity of the mini-vehicles carrying the third-stage standard boxes is calculated using the DSR approach to the design. With the help of DSR method, the commonly used mini autos are selected and their official indicators are obtained through literature review. The quality indicators of the third-stage standard boxes in the terminal distribution are obtained through simulation.

Taking DFSK K01 mini autos for example, this kind of mini-vehicle has a curb weight of 880 kg and maximum total weight of 1 790 kg with carrying capacity of 910 kg. Its size is 4 390 mm x 1 560 mm x 1 825 mm and loading gauge is 2 700 mm x 1 440 mm. The bare weight of the third-stage standard box is 10 kg. The results are shown in figure 7.7. It is obvious that the volume utilisation ratio and the weight-loss rate of cold boxes of the third-stage standard box are 3.84/6.2208=61.7%, 160/910=17.58% respectively. (The data indicators of Dongfeng truck can be found on Dongfeng's official website: https://www.dfmc.com.cn/)

Figure 7.7: Loading rate of mini-vehicles for terminal distribution



According to the calculation in figure 7.7, the mini-vehicle can carry up to 16 third-stage standard boxes, i.e. 750 kg of goods, therefore it can meet the loading requirements of terminal delivery.

In summary, according to the results of the simulation, the volume utilisation ratios of different standard boxes are respectively 89.76%, 89.55%, 82.34%, and 97.76%. The rates of weight loss of the first-stage, second-stage and third-stage standard boxes are respectively 16%, 17.6%, and 17.58%. Since their volume utilisation ratios all exceeds 80% and the weight loss rates are less than 20%, the design of these standard boxes is reasonable and effective. (Ning et al., 2017; Zhao, 2013). It can be seen from the data in Table 7.1 that the size design of the above four kinds of standard boxes is reasonable and effective.

In the four standard LCL box design schemes, the standard LCL boxes at the same level are consistent in length and width but differ in height. In order to avoid excessive sorting and the disconnected transportation of goods at the logistics nodes and improve logistics operations efficiency, the method of DSR is employed and the design idea of 40-foot standard containers is drawn on to design four series of standard LCL boxes that are consistent in length and width and are different in heights. The length and width of the first-stage standard LCL boxes should be suitable for line haul, feeder transportation and terminal delivery for large customers. They can therefore be transported both with a 12-meter semi-trailer and a city distribution vehicle.

Calculations reveal that the first-stage standard LCL boxes, second-stage large standard LCL boxes and the second-stage small standard LCL boxes have respective dimensions of 2.4 m and 2 m, 2 m and 1.2 m and 1.2 m and 1 m. These are used in city distribution for small customers. According to table 7.1, the length and width of the second-stage standard LCL boxes are designed in line with the requirements of mixed-loading of first-stage and second-stage standard boxes, so there is an integer proportional relationship between the size of first-stage standard boxes and that of the second-stage standard LCL boxes. For example, the first-stage standard LCL boxes with the length of 2.4m is twice as large as the second-stage small standard LCL boxes with the length of 1.2m.

The height of the standard LCL boxes in the first and second schemes are designed according to the height of the 40-foot standard containers. Taking the requirements of line haul transport and city distribution vehicles into consideration, the DSR concept is drawn on to initially set the heights of the first-stage and second-stage standard boxes. The line haul transportation model is shown in figure 7.8

The first-stage and the second-stage standard LCL boxes are 2.6 m in height, which is larger than the standard LCL boxes in the third and fourth schemes. Due to the height limit of urban distribution vehicles (Zhai, 2015), the city distribution vehicles need to be re-designed to make them suitable for the urban distribution of standard LCL boxes in scheme one and two. This will increase costs.

The height of the standard LCL boxes in scheme one and scheme two is designed based on the height of the 40-foot standard container. The height of the first and second stage of standard LCL boxes in the two schemes is 2.6 m, which means a larger capacity than that of the standard LCL boxes in scheme three and scheme four. However, due to the height limit of city delivery vehicles, the city delivery vehicles need to be transformed to adapt to the city distribution of the standard boxes in scheme one and scheme two, so the costs of these two schemes are higher.

The height of the standard LCL boxes in the third and fourth scheme can be changed to 2.4 m. Although there is a loss of cargo capacity, those standard boxes can meet the requirements for city distribution.

Finally, the standard LCL boxes design in the fourth scheme is recommended. The size of the four kinds of standard LCL boxes has a multiple relationship. According to the size of the four series of the standard LCL boxes in table 7.1, the multiple relations of the standard boxes of each stage can be seen. For example, the first-stage standard box is twice the length of the second-stage small standard box for the reason that the former has a length of 2.4 m and the latter has a length of 1.2m. They are therefore suitable for less-than-container loading. For example, two or four second-stage standard LCL boxes can be assembled into a first-stage standard LCL box. The first-stage standard LCL boxes are mainly used for line haul transportation as well as distribution for large customers, and the second-stage standard LCL boxes are mainly used for the feeder transportation and the terminal delivery for small and medium-sized customers. They can also be loaded with the first-stage standard boxes in line haul transportation. The third-stage standard LCL boxes are used for terminal delivery for individual customers based on the loading effect model according to figure 7.5 above.

Figure 7.8: Line haul transportation model

7.1.3 The design of standard LCL boxes

Based on the idea of DSR, the various factors affecting the efficiency of logistics operations are taken into consideration in this thesis. The standard LCL boxes are redesigned and rationalized (Zhang, 2013; Xie, 2017).

(1) Shape design

A forklift is required when loading and unloading standard LCL boxes. The fork similar to the forklift under the tray will be reserved. The specific thickness of the root of the fork and the length of the foot can be installed on the standard LCL box. This design is convenient for forklift operation (Zhu, 2016).

(2) Connection

When the goods are transported at high speeds, the standard LCL boxes are likely to fall from the vehicle. In order to solve this problem, corner fittings, similar to container corner fittings will be installed on the four corners of the standard LCL boxes for fixation. The corner fitting cavities have a radius of 20 mm and are 100 mm in depth.

7.2 Drop-and-pull transport based on standard LCL boxes

The standard LCL box is used for drop-and-pull transport based on the design of table 7.1 and figure 7.5. A 12 m low-bed semi-trailer can carry six first-stage standard LCL boxes (2.4 m*2 m*2.4 m) for line haul transportation (Fan, 2013; Yu et al., 2014). A vehicle with a loading gauge of 5 m*2.05 m*2.4 m can carry two first-stage standard LCL boxes (2.4 m*2 m*2.4 m) for feeder transportation or delivery to large customers. Small trucks can carry first- and second-stage standard LCL boxes for the distribution to medium-sized customers. They can also carry third-stage standard LCL boxes for delivery to small customers. After the various transport vehicles arrive at the transport nodes, they need only to unload the boxes. That is the completion of the distribution.

The one-line-two-ends drop-and-pull transport mode will be adopted for line haul drop-and-pull transport at each line haul hub node (e-commerce hub and e-commerce regional distribution centres). After the vehicles arrive at the line haul hub node "A", a tractor hitches the trailer carrying the standard LCL boxes filled with goods, moves to the line haul hub node "B" and drops off the trailer of the standard LCL boxes (with goods). It then hitches up the empty or fully loaded trailer to return to the line haul hub node "A" for the next delivery, thus saving time, lowering costs and reducing resource investment.

The loop drop-and-pull transport mode is adopted for transport between the regional distribution centres and e-commerce physical stores. For e-commerce physical stores in urban areas, the urban delivery vehicles with a load gauge of 5 m*2.05 m*2.4 m can be used for loop drop-and-pull transport. For the e-commerce physical stores in other areas, 12 m low-bed semi-trailers can be used for loop drop-and-pull transport. All e-commerce physical stores are equipped with a sufficient turnover standard LCL boxes. When the semi-trailer arrives at an e-commerce physical store, some or all of the standard LCL boxes are unloaded. The semi-trailer leaves for the next e-commerce store with the standard LCL box having been loaded by the chain store. It will repeat this process at the next physical store. The loop drop-and-pull transport mode will save on the turnaround time of goods delivered, in so doing leaving customers with more service response time, and improve service value and service quality (Zhang et al., 2013).

7.3 City distribution based on standard LCL boxes

The drop-and-pull transport mode based on standard LCL boxes is not only applied to line haul transportation， but also plays an important role in terminal city distribution:

(1) As for terminal distribution for large customers (including e-commerce cooperatives), the flatbed trailer with a load gauge of 5 m*2.05 m*2.4 m or the 12 m low-bed semi-trailer used for drop-and-pull transport. The goods in the standard LCL boxes have already been sorted and packed in the e-commerce hub. Each standard box is destined for a certain large terminal customer. After the standard LCL box is transported to the e-commerce regional distribution centre, without the need to sort and pack again, it will be delivered directly through loop drop-and-pull transport (Tao et al., 2014) to the customers. The distribution vehicles with a load gauge of 5 m*2.05 m*2.4 m can carry two first-stage standard LCL boxes and the 12 m low-bed semi-trailer can carry six first-stage standard LCL boxes. The first-stage boxes can also be mixed-loaded with other standard boxes. This LCL model can meet a single customer's demands for the transportation of different types of goods.

(2) Considering the loading order of the standard LCL boxes, the principle of “the first comer to the outside, and later comer to the inside” should be followed, so that the standard LCL boxes in the delivery process need not be disassembled individually, but are delivered to large customers one-by-one in order (Cano et al., 2009). Considering the costs, the delivery routes should be better selected, the delivery sequence should be planned in advance and the packing should be suitable for the required temperature in the process of distribution. At the same

time, the distance of the distribution must be considered, and the whole distribution process should put the reputation of the enterprise first (Zhou, 2005).

7.4 E-commerce terminal distribution

As the last-mile (terminal) service node of the logistics network, the logistics cooperative is mainly used for community terminal delivery services (Yuan et al., 2017). The terminal distribution of logistics cooperatives mainly adopts internet plus manual operation to complete community logistics distribution (Zhu et al., 2014). Increasing artificial intelligence automation technology has accelerated technology upgrading in the logistics industry in China, and the entire logistics industry tends to be "unmanned" (Feng, 2017). Currently, in addition to logistics cooperatives, advanced distribution technologies such as intelligent pick-up containers can also be used for terminal distribution services in places with a large flow of people, such as office buildings and schools (Qian et al., 2017).

As the terminal link of the entire logistics activity, terminal distribution, whose the direct purpose is to meet the logistics needs of the end customers plays an important role in affecting the customer experience. However, due to such characteristics of terminal distribution as scattered delivery addresses, random demand, and low incremental value, the logistics efficiency is restricted and the development of the logistics industry is thus hindered. A solution to the problems in “last-mile” delivery is proposed based on the characteristics of the terminal delivery in the following part: intelligent containers with the advantages of flexible time configuration, high efficiency, low cost and high security are introduced to reduce logistics costs and improve logistics efficiency.

7.4.1 Analysis of the characteristics of terminal delivery

Terminal delivery is a logistics activity that serves downstream customers in the supply chain, directly facing terminal customers and satisfying their detailed demands. It is therefore the key to the quality of the entire distribution service (Miao et al., 2018; Cai et al., 2014; Tang, 2016). Terminal distribution can be divided into e-commerce distribution and retail distribution according to different service recipients. There are certain differences and connections between the two terminal distribution modes and their respective characteristics are shown in table 7.4 (Zhao et al., 2009).

Table 7.4: Analysis of the characteristics of terminal distribution (Pope, 2010; Zhu et al., 2014; Yuan et al., 2017)

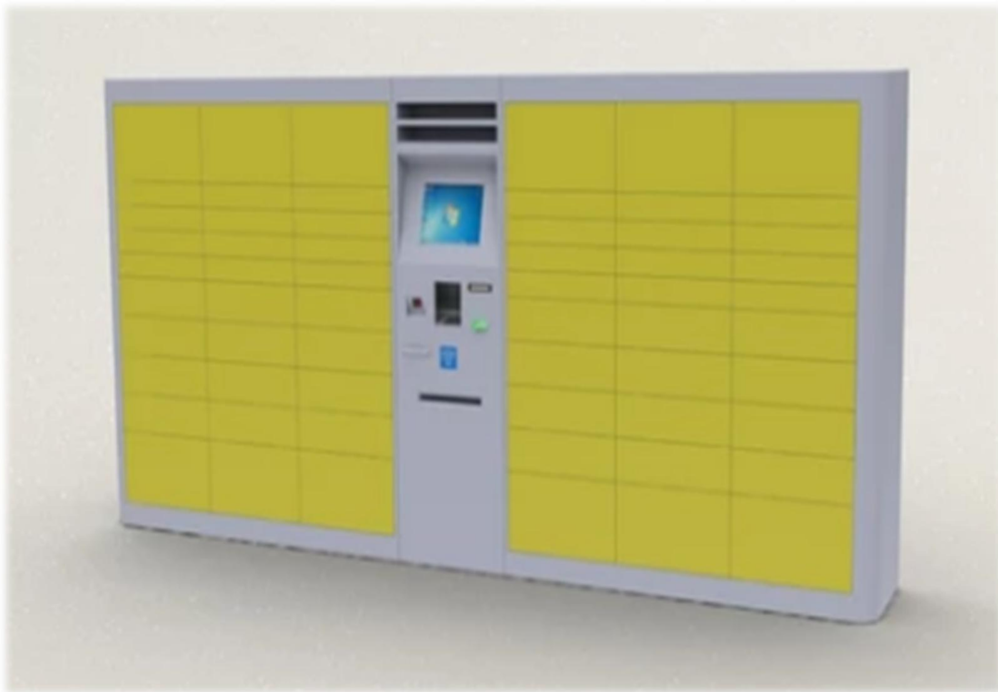
Number	The characteristics of e-commerce terminal distribution	The characteristics of retail terminal distribution
1	Small scale, multiple batches, small parcels, frequent delivery	Large scale, multiple batches, frequent delivery
2	Short transport distance	Transport distance is not far
3	Wide and concentrated demands	Relatively dispersed demands
4	The order quantity is uncertain and there is no rule to follow.	There are a large number of orders and certain rules to follow
5	Return rate is high	Return rate is relatively low
6	Once-delivery failure rate is high	Delivery failure rate is low
7	High requirements for real-time tracking of goods	Low requirements for tracking of goods

It can be seen from the above analysis that terminal delivery is a small-scale activity that provides personalised delivery services for consumers and businesses. In the traditional terminal delivery mode, where the goods are delivered to customers by the self-operated distribution centres or warehouses of the enterprises, the enterprises need to be equipped with more human and capital resources. In addition, if disorganised, problems like the loss of goods, the delay of delivery and low customer satisfaction will occur.

7.4.2 Popularisation of intelligent pick-up containers

A self-service pick-up cabinet is a type of intelligent self-pick-up service equipment designed to avoid wasted trips of deliverymen in the case of customers happening to be absent from home. It is usually set up in public places, such as communities and subways, where there is a large flow of people. The self-service pick-up cabinet is similar to a supermarket locker in shape (Zhang, 2014; Chan, 2016; Zhang et al., 2015). There is a computer display in the middle. Each pick-up cabinet has several boxes of different specifications. The deliveryman only needs to scan the barcodes on the express items, place the items into the corresponding boxes and input the customer's mobile phone number. The system will automatically send a text message to the customer and the customer can collect their goods according to the received serial code. The self-service pick-up cabinets provide 24-hour service with added safety and convenience. Compared with the current mode, it can reduce the time wasted in delivery, lower the damage rate of the packages and effectively avoid the disclosure of personal information of customers (Hu et al., 2015).

Figure 7.9: Intelligent pick-up cabinet (Qian et al., 2017)



The intelligent pick-up cabinet consists of two parts: The front-end system and the background operating system. The specific schematic diagram is shown in figure 7.10 and figure 7.11 (Qian et al., 2017).

Figure 7.10: Schematic diagram of the front-end hardware of the intelligent pick-up cabinet system (Zhang et al., 2016; Dong, 2014)

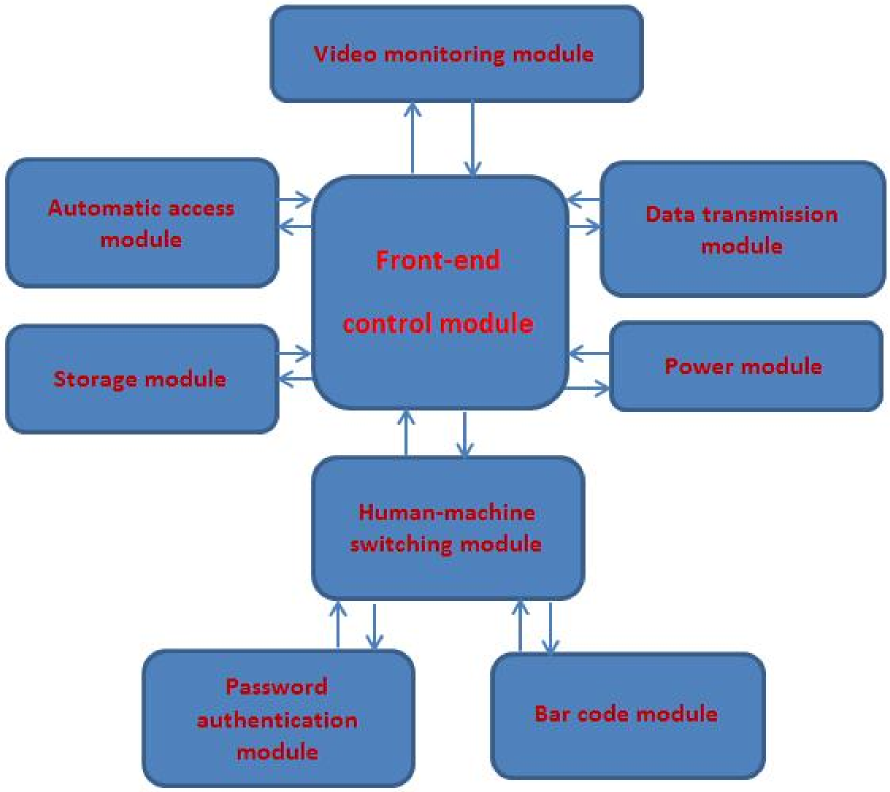
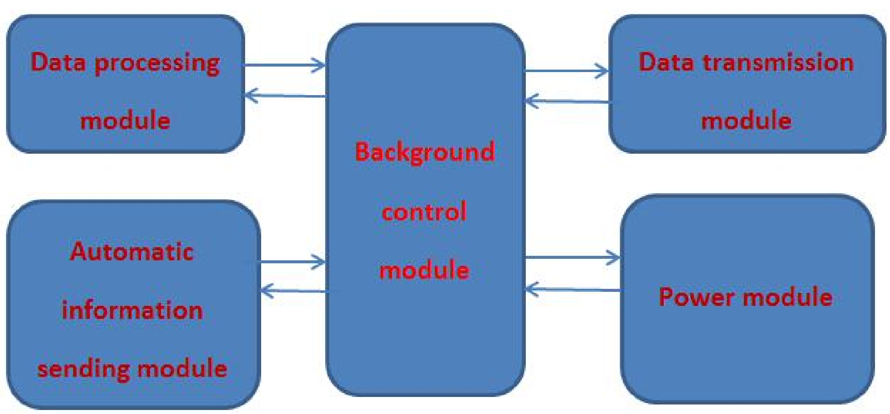


Figure 7.11: Schematic diagram of the background hardware of the intelligent pick-up cabinet(Luo, 2016; Cui et al., 2015)



Although the automatic pick-up cabinets have many advantages, there are still many disadvantages. Examples include the following (Du et al., 2015):

- The self-service pick-up cabinet is not suitable for the elderly or other "electronic illiterate" people.
- The pickup text message sent by the system may be blocked by the customers.
- Some customers are accustomed to the traditional delivery method, so this new self-service pick-up cabinet is not acceptable to them.
- There are no rules and regulations for self-service pick-up cabinet management at present, creating difficulties for promotion in communities.
- It is difficult for logistics enterprises to achieve profitability in the short term because the initial investment and subsequent operational and maintenance costs, and both the volume of the package and the number of packages is limited.

7.5 Summary

In this chapter, the simulation method and DSR are adopted to study the research questions of the design of standard LCL box and the application of drop-and-pull transport mentioned in section in 1.3 and 1.4. The traditional containers were transformed into four-stage standard LCL boxes that will save loading space and improve sorting efficiency. At the same time, the four-stage standard LCL boxes are better applied through drop-and-pull transport, improving the logistics efficiency, which is also an important part of e-commerce collaboration. Furthermore, the collaboration of all parties involved in supply chain is inseparable from the support of the network big data platform. When building a strong logistics system, e-commerce businesses could take advantage of their strength in terms of network big data to enhance the connectivity of the entire e-commerce logistics system and break the time-and-space barriers in logistics process, thereby greatly improving logistics efficiency. Therefore, the next chapter will focus on the improvement and development of e-commerce big data platform, build the cloud platform to realize the collaborative integration of e-commerce and logistics systems.

Chapter 8:

E-commerce big data platform

The establishment of the chapter 7 logistics system makes it possible for all parties involved in the supply chain to cooperate with each other. When building a strong logistics system, e-commerce should take advantage of its strength in terms of network big data and promote the improvement of the network big data platform (Xiong et al., 2014; Hu et al., 2018; Peng et al., 2014).

It is employed in this chapter together with the methods of the literature analysis and observation mentioned in Chapter three to complete the establishment of the e-commerce cloud platform proposed in section 1.3.5. Through the review and analysis of the research status of e-commerce data platform at home and abroad and by observing the development modes and limitations of the existing platform comprehensively the information platform is improved and innovated with the consideration of the needs of both customers and enterprises. The scheme in this thesis is proposed based on the traditional network platform that only has the function of information display and internal application (He, 2014; Pan, 2010) and combines the logistics alliance and management system. It is intended to create an integrated, comprehensive and convenient information system with the consideration of both internal and external elements so as to achieve efficient operation and smooth information flow, and the dual goal of guaranteeing both customer satisfaction and employee convenience (Qiu et al., 2018). Through the collaboration of the information platform and the logistics system, effective management of the increasing information is realized, so that the information between each operation link is exchanged and communicated in a timely and accurate manner, and the parties involved in the supply chain are interconnected and collaborative, thereby improving logistics efficiency. It is also one of the overall research objectives of this thesis to make the efficiency of e-commerce logistics even better with the help of collaborative management of information platform.

This improvement is aimed at the information part and focuses on the optimisation of the network platform. It concerns logistics alliance, e-commerce and management systems (Hu, 2018). The logistics alliance mainly involves the integration of franchised vehicles and crowdsourcing logistics (Liang et al., 2017; Devari et al., 2017), while the management system is divided into a vehicle dispatching platform, warehouse supervision system, “information nest” (Lu, 2010) and standard LCL boxes supervision.

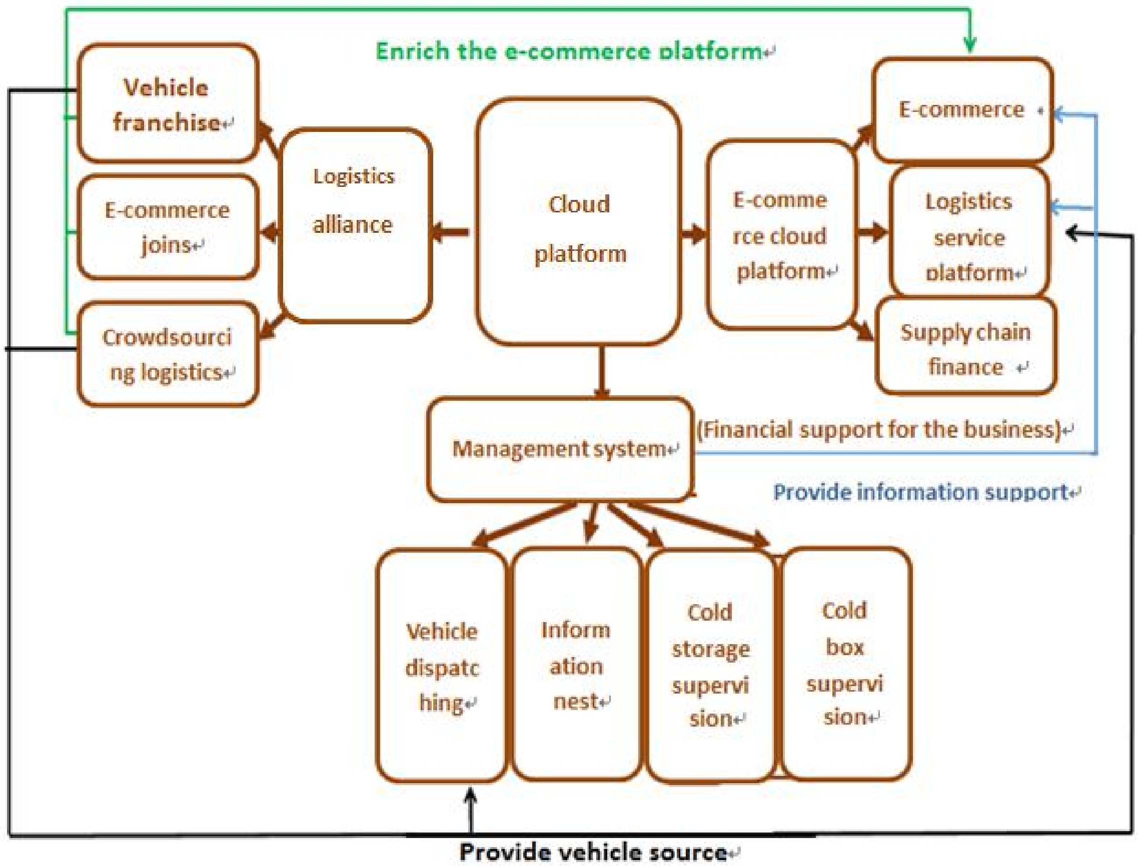
Compared to the traditional network platform of e-commerce, this platform realises the interconnection of multiple interfaces and integrates multiple functions on the network platform, thus avoiding multi-party operation and the phenomenon of “information islands” (Peng et al., 2014; Huang et al., 2019).

When the users log on to the system and enter their usernames and passwords, they will be able to access the external page or the internal page, depending on their users' rights (Lacka et al., 2014; Yang et al., 2017). For example, customers will log on to the e-commerce platform while employees will log on to the internal vehicle dispatching platform or access the “information nests” (Yang et al., 2010), warehousing information management and regulatory systems for modification and control (Regan et al., 2011; Ni et al., 2017).

The existing e-commerce system is generally divided into two parts: The internal management system and the external website. The former is for internal employees and the latter is for external customers. The two parts belonging to two systems operate independently of each other. This mode effectively avoids mutual interference of the two parts, but also presents some problems (Liu, 2014). For example, employees can only operate on computers with relevant internal ports, which may not achieve timely management and tend to cause the phenomenon of "information islands" (Egger, 2000; Shiang, et al., 2016; Yuan et al., 2011). This scheme combines the two parts to create a more complete and thus improved "e-commerce big data platform". The study in this thesis improves the information platform based on the existing e-commerce system, adopts the idea of collaborative management, and integrates the logistics alliance and management system. The purpose of establishing this platform is to integrate external transaction and logistics data with internal management in order to facilitate collaborative management and interoperability.

Based on collaborative theory, the platform integrating logistics alliance, management system and e-commerce service platform is aimed to be a connective and operative information service platform for all parties involved in the supply chain. The frame of the platform is shown in figure 8.1

Figure 8.1: The frame of the platform



8.1 Logistics alliance

E-commerce enterprises require many vehicles to build their own logistics systems. If all investment funds are used to purchase vehicles, the capital investment is high and it may cause waste (Lu, 2010; Albers et al., 2016; Brekalo et al., 2013). Therefore, the integration of vehicles should be added to the platform. The logistics alliance covers drivers' join-in, vehicle franchising, and crowdsourcing logistics. It integrates the businesses of the enterprises with the idle resources in society, expanding the scope of business while solving the problems in terminal distribution.

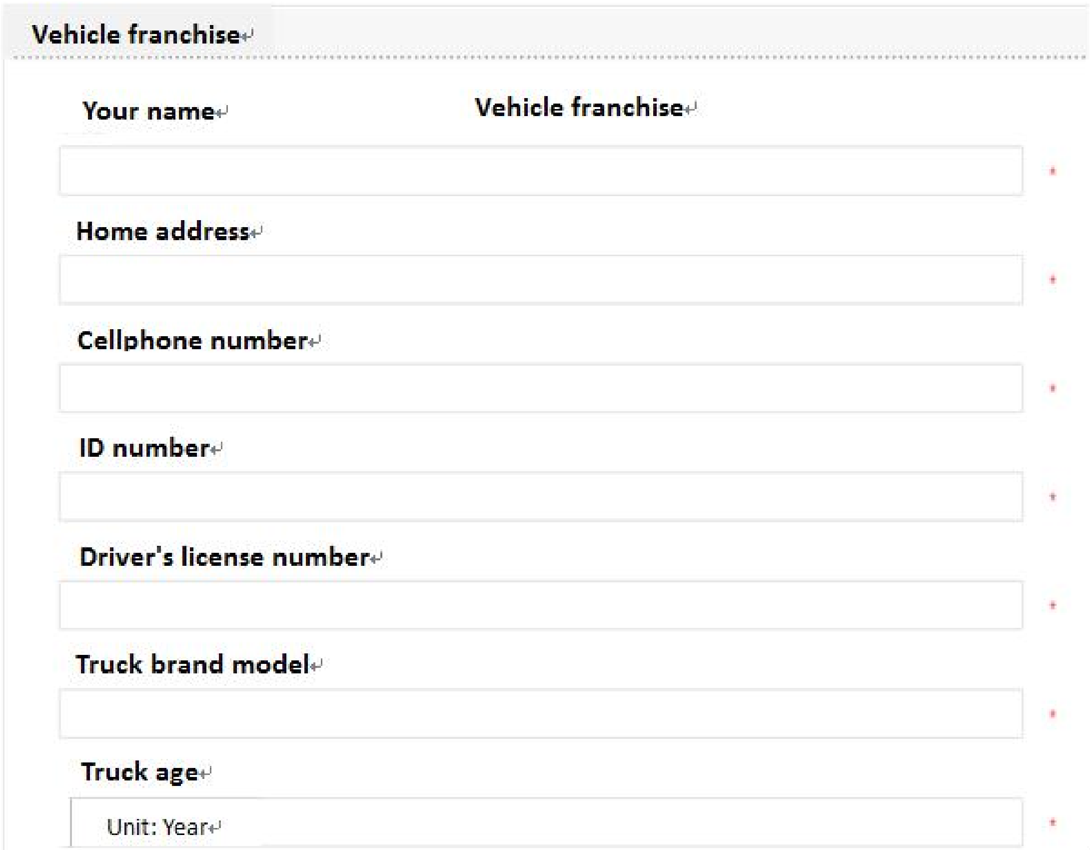
8.1.1 Drivers join-in

The drivers who intend to join in the logistics alliance platform should submit a registration application and personal information to the enterprises, and then the enterprises will check their information within a certain period (He et al., 2006; Zheng et al., 2012; Brekalo et al., 2013). If they qualify for registration, they will be approved and the relevant documents will be sent to the relevant department. The department will register and number the qualified drivers, and provide feedback about their own number and password to the drivers (Albers et al., 2016).

8.1.2 Vehicle franchise

Similar to the process of drivers' join-in, the franchised vehicles have their own specific number and password. The administrators log on the e-commerce platform with the numbers and passwords to query the specific conditions of the vehicles. (Qu et al., 2011; Liu, 2011) Vehicle franchise is shown in figure 8.2.

Figure 8.2: Vehicle franchise (Yang, 2010)



Vehicle franchise

Your name Vehicle franchise

Home address

Cellphone number

ID number

Driver's license number

Truck brand model

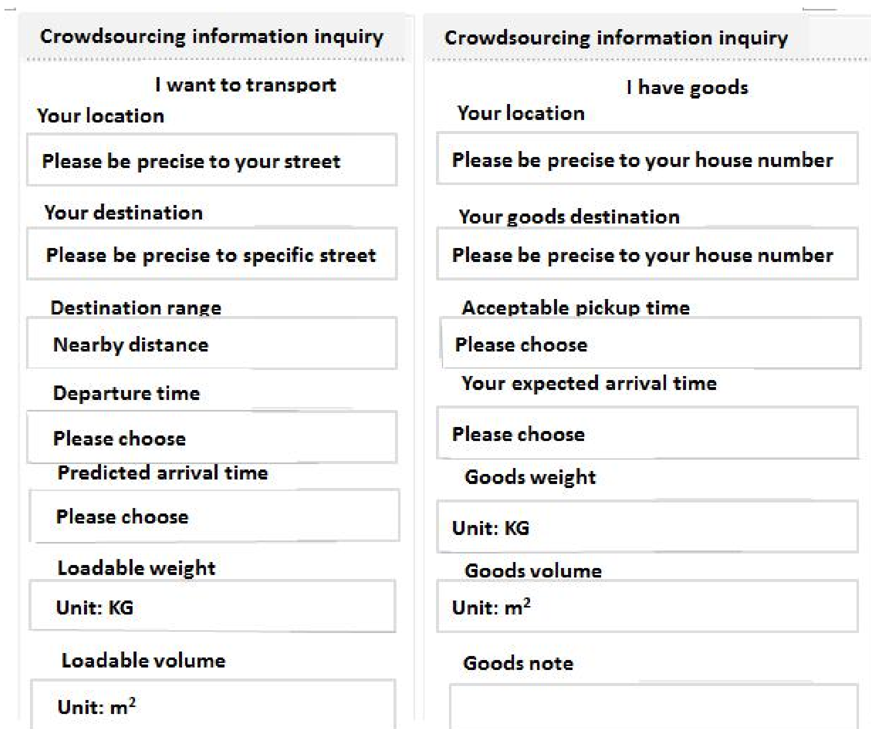
Truck age

Unit: Year

8.1.3 Crowdsourcing logistics

The “last-mile” delivery has always been a challenge in logistics. This concerns how to save money and how to deliver goods more efficiently. It is necessary to combine crowdsourcing logistics with the logistics network established and cooperate in terminal delivery with the express enterprises that are responsible for the delivery to individual users (Mladenow et al., 2015; Brown et al., 2014). Users can use the crowdsourcing information platform to conduct transaction contacts, information inquiry, goods monitoring and make crowdsourcing information queries for the benefit of their personal interests. The process of crowdsourcing information queries is shown in figure 8.3.

Figure 8.3: Crowdsourcing information query



8.2 Management System

The e-commerce platform should be combined with enterprises' internal management system that is composed of a vehicles dispatching platform, warehouse Visible Board system, e-commerce and cloud platform (Luo et al., 2004; Kuang, 2014). The upgrading of vehicle dispatching platform and the application of warehouse supervision system are the reflection of the completeness of information and the visualization of transportation. The integration of e-commerce cloud platform promotes information sharing among all parties involved in supply chain and breaks the time and spatial barriers, thus improving logistics efficiency.

8.2.1 Vehicle dispatching platform

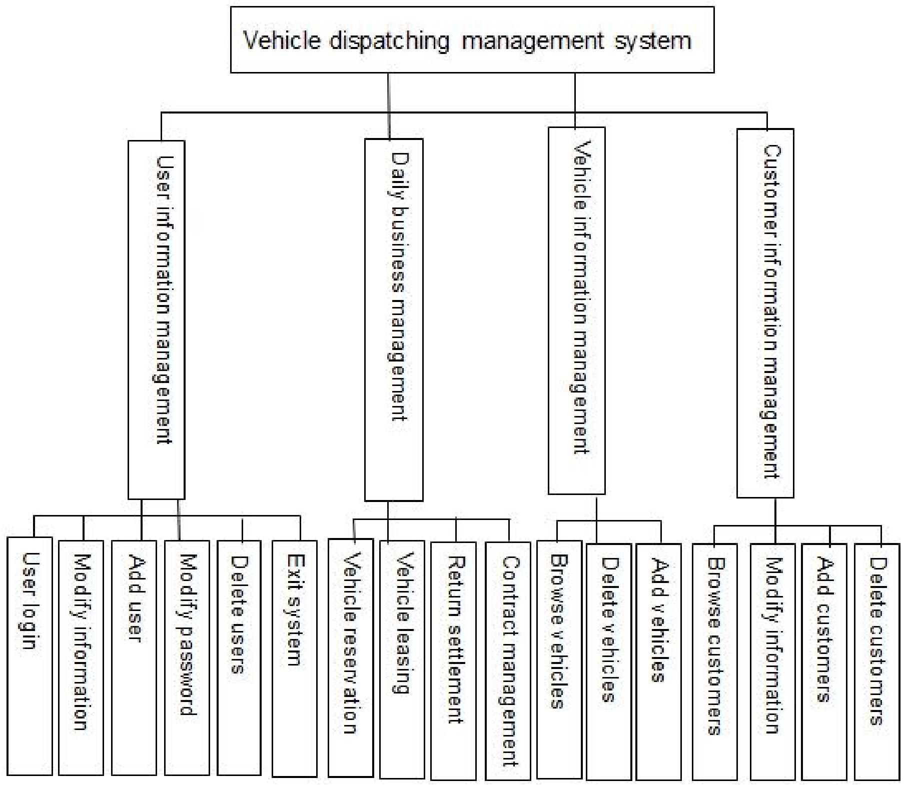
A vehicle dispatching platform is mainly used for vehicle dispatching scheduling and vehicle-goods matching. All The entire information of all vehicles should be recorded into the system, such as the car model, cargo capacity, driver’s name, driver's phone number, vehicle monitoring information, etc. After the administrator adds the vehicle information, the driver can check his shift. When the basic information such as the driver's phone number changes, the driver can ask the administrator to modify or delete relevant information. Meanwhile, if the completeness and accuracy of the vehicle information on the platform and the access of the platform are secured customers can access all shifts and vehicle arrangements by themselves.(Du et al., 2007; Yin et al., 2014). After a customer places an order, the vehicle information will be automatically matched through the big data processing system and the driver will receive the information of the order from the customer service personnel, and then they will start to deliver goods (Luo et al., 2004).

Franchised vehicles have already signed contracts with enterprises when they registered. After that, the monitoring systems of the vehicles will undergo unified arrangement and GPS tracking systems will be set on the franchised vehicles to conduct real-time monitoring. Meanwhile, the vehicles should send feedback to the monitoring headquarter while arriving at each logistics node (Wang, 2014; Ma et al., 2013).

For flatbed trucks that transport the standard LCL boxes,(this thesis specifically introduces the design of standard LCL boxes, the design idea behind 40-foot standard containers is drawn on and four series of standard LCL boxes is set out) monitoring systems equipped in the standard boxes adopted to realise the connection to the franchised vehicles monitoring system (Yuan et al., 2017). The vehicle dispatching platform plays an important role in the operation of the entire logistics network, the drop-and-pull transport and the terminal distribution.

The functional modules of a "vehicle dispatching system" include the following: User information management, day-to-day operations management, vehicle information management and customer information management. Among them, day-to-day operations management is the core functional module of the system. The functions of other modules are shown in figure 8.4. If all functional modules are effective in basic information interaction and collaboration, the vehicle route selection and vehicle-cargo matching can be completed to certain extent. Therefore, the cost is saved, the enterprise profit is increased, and the logistics efficiency is improved.

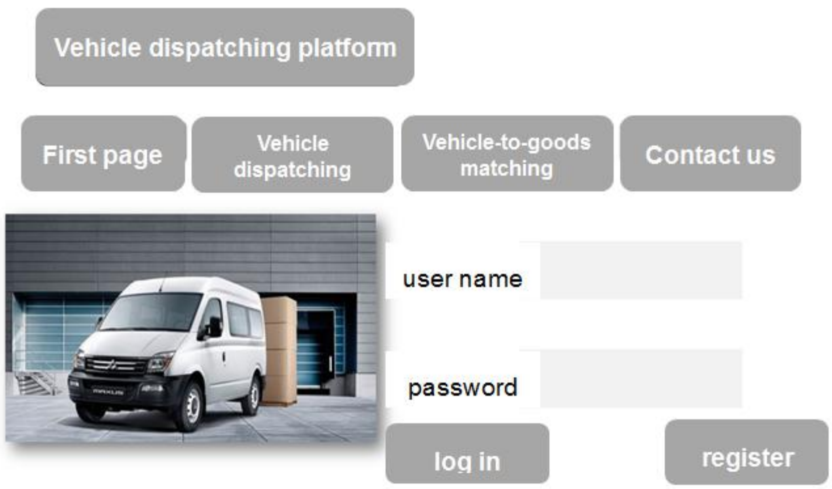
Figure 8.4: Functional modules of the vehicle dispatching management system (Chakraborty et al., 2015; Cai et al., 2011)



8.2.1.1 Vehicle dispatching platform management interface

The first tier of the platform interface is the login interface. The platform staff logs on the platform as an administrator, and they have the rights to administer the platform. These include checking whether the information published by the platform is false, illegal or expired, monitoring background data, and contacting the goods owner (Yuan et al., 2017; Zhu, 2014). Registered users can log on to the platform to show the sources of goods or vehicles and browse the information on the platform to identify the right customer. Registered users log on the platform to show the sources of goods or vehicles and browse the information on the platform to identify the right customer. After identifying the customer, they can sign the relevant contract on the platform and conduct a series of operations such as vehicle charting, paying rent, paying freight and returning vehicles (Ichoua et al., 2006; Ye, 2015) The login interface of vehicle dispatching platform is shown in figure 8.5.

Figure 8.5: The login interface of vehicle dispatching platform

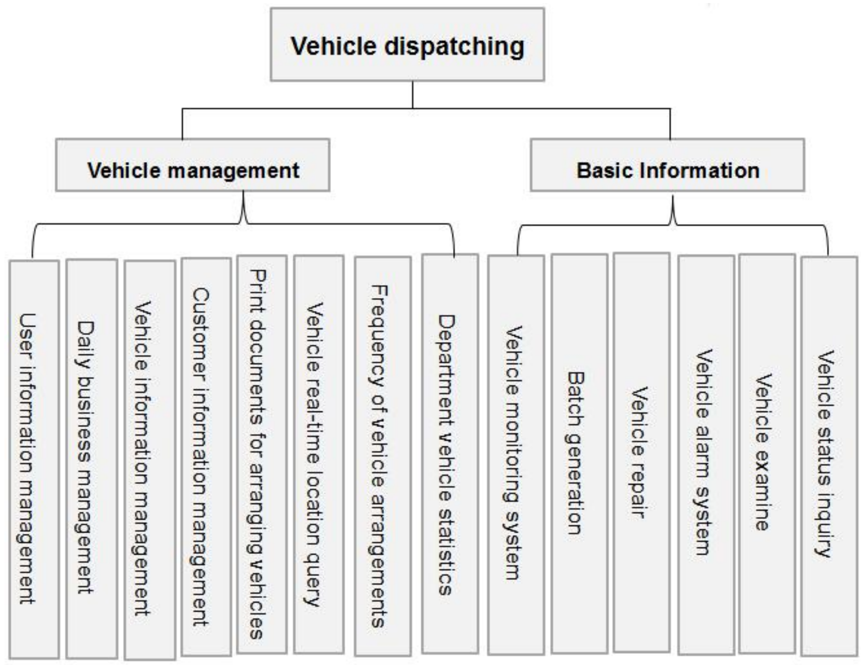


The vehicle dispatching interface must record all the information of franchised vehicles involved in the platform on the system, such as vehicle model, cargo capacity, driver’s name, driver's phone number, vehicle monitoring information.. The vehicle dispatching interface records all the information of franchised vehicles involved in the platform on the system, such as vehicle model, cargo capacity, driver’s name, driver's phone number, vehicle monitoring information (Li et al., 2013; Wei, 2017). After the customer places an order, the vehicle information is automatically matched by the big data processing system (or it is selected by the goods owner), and then the driver delivers goods after receiving the order information from the customer service personnel (Rattanamanee et al., 2017).

Franchised vehicles should sign contracts with the platform when they register. After signing the contract, the monitoring systems of the vehicles will undergo unified arrangement (Rattanamanee et al., 2017). Unified GPS (Global Positioning System),RFID (Radio Frequency Identification) and alarm devices will then be installed on the franchised vehicles to monitor the real-time conditions of the vehicles. Simultaneously, the vehicles will send feedback to the monitoring headquarters while arriving at each logistics node (Sun et al., 2010; Zhang et al., 2013; Deng et al., 2010). RFID technology combined with GPS system is helpful to realize the all-round visual tracking of the logistics transportation process. (Lee et al., 2011) When goods or transport vehicles with electronic tags pass through a logistics node, the monitoring headquarters receives feedback to ensure the safety of the vehicles (Zhong et al, 2016; Shi et al., 2011). The RFID system on the transport path is used to locate and track the vehicle in real time, and timely access the transportation information of the goods in transportation, which is convenient for enterprises to conduct remote dispatch management (Viani et al., 2012; Deng et al., 2010).

The GPS will only fulfil the function of monitoring during transportation after the customers accept the order, which will assist to protect the privacy of the vehicle owners (Zhang, 2013). The vehicle dispatching platform therefore plays an important role in the operation of the entire logistics network and terminal distribution. The related contents of vehicle dispatching are shown in figure 8.6.

Figure 8.6: Related contents of vehicle dispatching platform (Chen et al., 2018; Shuang et al., 2010)

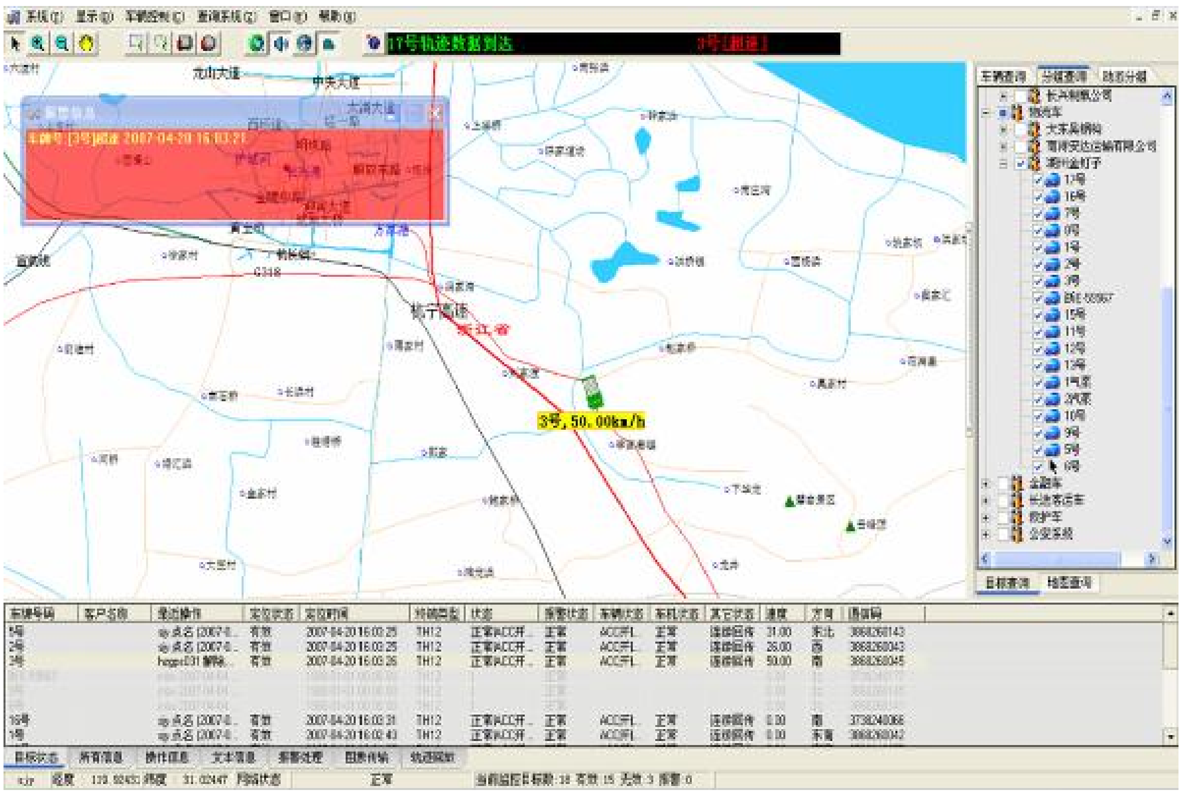


When dispatching vehicles, the system will manage the vehicles and their position rigorously. The state of the vehicles is monitored precisely by the system in order to lower the risk of accidents during transportation.

The GPS vehicle monitoring system will monitor the moving vehicles around the clock and identify their exact position, velocity and direction on the electronic map. Feedback about the ignition and flameout, opening and closing the door and travelling distance can be sent at any time (Dan et al., 2010; Hui, 2010). The place and time of loading and unloading goods can also be monitored (Huang et al., 2014).

Meanwhile, the monitoring headquarters can accept various alarm signals from the vehicles and locate them. It will then determine corresponding solutions, such as listening to and tracking vehicles, notifying the drivers and forced fuel cut or flameout through remote control (Huang et al., 2014).

Figure 8.7: Vehicle monitoring (Barcelos et al., 2014; Jose et al., 2015)



8.2.1.2 Vehicles-goods matching – intermediation

In the future, when the vehicle is automatically dispatched, it is also matched with the goods being delivered, thereby lowering the cost of human resources and improving transportation efficiency (Hu, 2014).

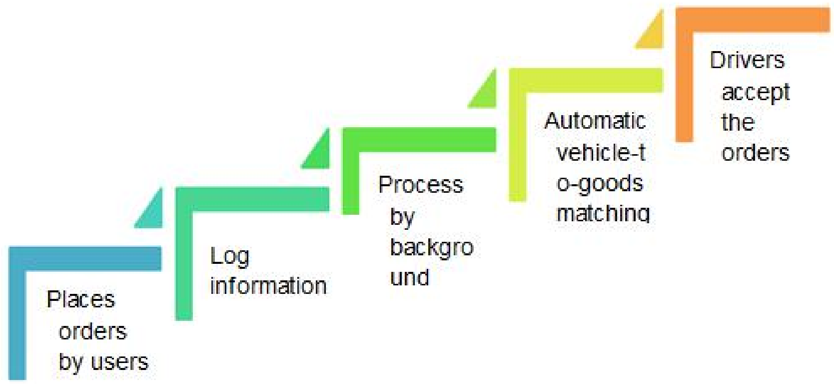
With the assistance of big data, the vehicles-goods matching platform is used to match the shipping addresses of customers and vehicles so as to reduce duplicate matching between vehicles and goods, improve distribution efficiency and increasing the full-load rate. It also releases information online and more precisely matches the information to resolve logistics information asymmetry (Chen et al., 2011; Lu et al., 2012; Xie, 2017).

The vehicle dispatching platform utilises searching and matching technology, data mining technology and big data processing to provide information for matching, such as the source of goods and vehicles to enterprises and drivers. It also performs multi-dimensional matching between the goods and the vehicle owners, reducing the workload of manual operation and improving work efficiency (Xu et al., 2017).

Vehicle-goods matching achieved through the big data processing platform. This reduces logistics costs and the empty-containers-rate, and improves overall logistics efficiency.

The vehicle dispatching platform is aimed at limiting the transport costs as far as possible through calculations performed by the information system (Perdana et al., 2012; Wang, 2012). The specific implementation falls into two types: Matching according to the established route (simple system matches the vehicle with the goods according to the original route) (Xiong et al., 2014) and vehicle-goods matching. The latter is shown in figure 8.8. After the user places an order, the platform performs information processing and automatically conducts vehicle-goods matching according to the user's needs and the designated tasks. Then the step is the drivers' accepting the orders.

Figure 8.8: Vehicles-goods matching



8.2.2 Warehouse management

The warehouse management system consists of warehouse Visible Board system, monitoring center and login system. The application of the warehouse management system realizes the visualised operation of the warehouse. Based on the improvement of the Visible Board theory, the standardised operation method and the dynamic management method are used to predict and solve the abnormal cased in advance, and improve the operation efficiency under the premise of ensuring the safety of the warehouse.

8.2.2.1 Warehouse Visible Board system

The warehouse electronic Visible Board system is added to the management system to improve the operational efficiency of the warehouse. Visible Board theory, introduced by Toyota, has greatly improved the operational efficiency of the warehousing system (Lam et al., 2015). This research study intends to make the traditional Visible Board theory input in computers to form electronic Visible

Board that will strengthen the use and coordination of Visible Board information through the processing of big data (Huo et al., 2006; Morita,2014). Simultaneously, it will enhance the coordination of warehouse operations and the efficiency of manual operations.

8.2.2.2 Monitoring centre

The monitoring centre consists of video surveillance and warehouse fire alarm monitoring. The monitoring system is divided into the control centre and control sub-centres. The control centre has an online inspection function provided by the senior management. The control sub-centres are responsible for the supervision and equipment management of each warehouse (Bottero et al., 2013; Yao et al., 2014; Geman et al., 2017).

The corporate headquarters supervise the control centre. It is also responsible for the supervision of second level control sub-centres and can view the real-time situation of each warehouse (Wu et al., 2003).

8.2.2.3 Login system introduction

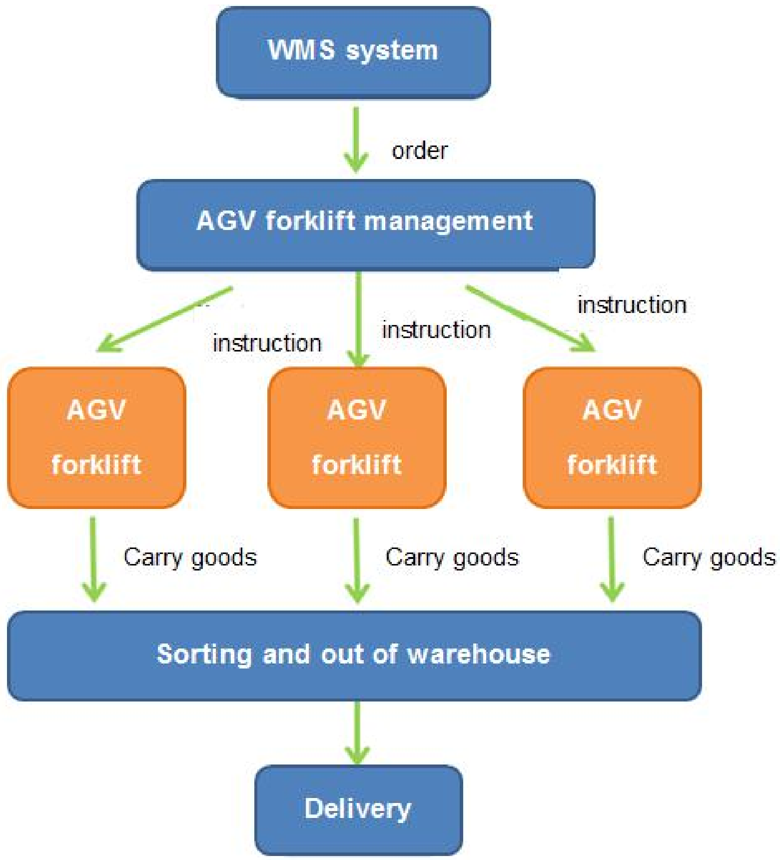
Each warehouse administrator has a login account. According to the security level of the login account, the administrator will be granted different rights. The login account is divided into types based on the needs of internal and external data. (Abbad, 2013). For example, after a warehouse administrator logs in, what he can see is only the monitoring status and historical monitoring data of the warehouse under his management. He can also conduct certain operations on the warehouse managed and the operational data recorded by the system. The administrative staff has login accounts with more rights in superior alarm and surveillance centres (Lu *et al*., 2009). This means that they not only have the rights to carry out the above operations, but also view the operational data of inferior administrators. This will be helpful to guarantee the security of warehouse supervision. In addition, real-time monitoring of the entire service range of the system can also be realised and the corresponding operational data is recorded by the system. Therefore, problems can be precisely estimated in case of any security accidents (Zong et al., 2017).

8.2.3 AGV (Automatically Guided Vehicle) forklift management system

The application of the automated AGV forklift can realise unmanned operations in the warehouse area. It can automatically transport the goods out of the warehouse according to the instructions, and then carry out the unloading or sorting (Zhao et al., 2017).

The management of the AGV forklift is added to the warehouse supervision. The WMS (Warehouse Management System) system automatically generates the order and sends instructions to the AGV forklift management system. The staff then sends instructions to each AGV forklift and the AGV forklift works according to these instructions and transports the goods out of the warehouse where the staff conducts sorting, and then the goods are delivered to their destination. (Giglio, 2014) AGV forklift operation flowchart is shown in figure 8.9.

Figure 8.9: AGV forklift operation flowchart (Giglio, 2014)



8.3 Information nest

The "information nest" is aimed at avoiding the phenomenon of "information islands", reduce the problems of information dissemination delay, information omission and information distortion, and ensure the effectiveness and authenticity of information (Liu, 2004; Wei et al., 2012; Michelberger et al., 2012). So far, most of the information has been disseminated layer by layer. The repeated transmission and reference of information not only leads to inefficient transmission, but also easily causes information distortion. Therefore, the problems of "information distortion" and "information islands" inevitably exist. By establishing an "information nest", the information is collected and stored in a centralized manner, and the useful information is directly passed to the staff through the system. Establishing an information gathering system will be helpful to solve the problems identified above (Deng et al., 2008; Luo et al., 2010; Shull et al., 2013).

The workflow of the “information nest” is basically as follows (Bouchelligua et al., 2010):

- Firstly, the staff collects “first-hand information” filter, classify and integrate the information to obtain effective data, which will be uploaded to the e-commerce cloud platform. The background system can sort and classify the information in a more detailed and effective manner based on order details, vehicle dispatching, standard box control, status and quantity of delivery goods to form a sound system (Hazen et al., 2012).
- Secondly, other staff, administrators or customers can log on to the system with their own login accounts and then they can recover the information they need. This will save time by avoiding layer-by-layer information dissemination (Olorunniwo, 2010).

Among all the functions of the “information nest”, the most important is that the staff in the e-commerce hub, the e-commerce regional distribution centres, the e-commerce physical stores and the e-commerce cooperatives can input the “source information” and “terminal information” (such as order details, vehicle dispatching, standard box control, status and quantity of delivery goods, etc.) into the computer at any time (Zhu, 2004). This information can be shared with the vehicle dispatching platform, cloud platform or e-commerce platform through the internet, sharing via the Internet on a dedicated platform， thereby truly realising resource sharing.

8.4 Supervision to standard box

The standard boxes are numbered in the aforementioned design schemes and are classified and recorded electronically according to the stage standard boxes stage. Implanting the RFID chip in the standard boxes will help the standard box supervision system to monitor the standard boxes at any time and stage of transportation (Lee et al., 2009; Zhong et al., 2016). After scanning a box, all the information of the box, including its contents is automatically recorded on the computer system. This is an effective method to trace goods. At the same time, the real-time conditions of the standard boxes reported by the e-commerce hub, the e-commerce regional distribution centres, the e-commerce physical stores and the e-commerce cooperatives are checked and registered. This will achieve real-time supervision of standard boxes and goods, and prevent loss of goods and standard boxes (Bai et al., 2010).

Meanwhile, since standard boxes are valuable assets for the enterprise, they should be recorded on the computer system before being put into use in order to prevent loss and achieve convenient management. The system can automatically track the standard boxes after they are put into use. When the standard boxes arrive at a network node, the staff will scan the RFID tag with the RFID reader and then the background system RFID application will be connected automatically to register the boxes in the warehouse supervision system (Chow *et al*., 2007). The background system will automatically match the information of each standard box to check the location of the standard box and goods, thus ensuring the supervision of the standard box and traceability of goods in circulation (Zhang *et al*., 2010).

8.5 Summary

The construction of the entire cloud platform will lay a solid foundation for the daily operation and future development of the enterprises. The logistics alliance integrates the business of the enterprises with the idle resources in society so that they may easily expand their business scope. In terms of the overall operation, either the logistics network built above or the daily transportation is inseparable from the vehicle dispatching platform.

In this research, the vehicles-goods matching function is added and the vehicle monitoring system is modified. This makes the traditional vehicle dispatching platform more effective.

At present, the study and application of the warehouse supervision system in the industry realises the visual operation, and automation will enable enterprises to take the lead within five to ten years.

Simultaneously, the establishment of the "information nest" will be helpful to solve the problem of "information islands".

The construction of the entire cloud platform involves pre-purchase, customer contact, supervision during transportation, visualisation of warehousing and future development, and the cloud platform will run through the entire operational process of the enterprise (Marakas et al., 2003).

The cloud platform will also become more comprehensive, convenient and integrated. This is of great importance to future development.

By improving the Visible Board theory, the warehouse electronic Visible Board system is embedded in the management system, which may improve the coordination and efficiency of the warehouse operation. At the same time, the login system ensures the security of the warehouse supervision through the permissions setting. The real-time monitoring and hierarchical management of the monitoring system realizes the visualised operation of the warehouse and improves the security of the warehouse management. Besides, the application of automation technology makes the warehouse operation more professional and efficient.

The establishment of the information nest organizes the complicated first-hand information into a complete and feasible information system. Then information is directly transmitted to customers or the staff through the login interface as requested. It may avoid the troublesome level-by-level information transmission and the “information island” phenomenon.

Through the application of RFID technology, the standard box supervision is conducted and the flow process of the standard box is monitored in real time so as to prevent the accidental loss of goods and standard boxes, thus ensuring the natural circulation of goods.

The construction of the cloud platform contributes to the collaborative integration of e-commerce and logistics systems. Based on collaborative theory, the logistics alliance, e-commerce platform and its internal management platform are integrated. Through “information nest”, users’ information and logistics dynamic data are integrated to promote information sharing among all parties involved in the supply chain, avoiding the phenomenon of “information islands” and improving logistics efficiency. Meanwhile, the application of the monitor platform helps to visualised management of transportation and warehousing to ensure the safety of goods and transportation equipment. The completed cloud platform will run through the entire operational process of the e-commerce enterprise and become a comprehensive, convenient and integrated platform, which will play a very important role in the future development.

The data support of the information platform is closely related to the operation of the logistics network. When constructing the information platform, the operation of the logistics network should be taken into consideration (Córdova et al., 2014). At the same time, it is necessary to take the components of urban logistics into account in order to coordinate various organisations and make full use of existing social resources by means of advanced science and technology.

The improvement and development of the e-commerce big data platform will contribute to improving the logistics system and logistics efficiency, and promoting the development of e-commerce, which is an indispensable key in the process of better applying the e-commerce collaborative theory to the logistics system. The next chapter will summarize the thesis and analyze the contributions and limitations of the study.

Chapter 9:

Conclusions, limitations and prospects

9.1 Introduction

This chapter discusses the research theme, results, and conclusions of the thesis. It makes a conclusion to the new e-commerce logistics system proposed based on collaborative theory. Some novel contributions that the radial-spoke logistics network, standard LCL boxes and information platform mentioned in the thesis may make are discussed. Furthermore, the limitations of this study will be addressed and prospects for future research made.

9.2 Conclusions

In chapter five, the proposal of e-commerce collaborative theory opens the door to real-time interaction of logistics and information and provides a solution for the collaboration of all parties and a guarantee for the rapid development of e-commerce. “Collaborative management” may help e-commerce enterprises to maintain competitive edge in this rapidly growing field. E-commerce collaborative management provides opportunities for e-commerce enterprises to better understand issues facing them and to identify problems timely.

In the era of the internet, e-commerce has developed rapidly. As an important part of e-commerce operations, logistics is not only a matter of the transportation of goods, but also concerns the customer experience. Therefore logistics plays an important role in e-commerce management. In section 5.2, 5.3 and 5.4, the research on e-commerce logistics from the perspective of collaborative theory bridges the gaps in e-commerce in terms of time and space and provides possible solutions to the better performance of the first and last mile of delivery. It was also the ultimate goal of the thesis to fit the e-commerce collaborative theory to the construction of logistics system so as to improve logistics efficiency and reduce logistics cost. Targeted conclusions to achieve the research objectives are shown in what follows:

Conclusion 1 targets Research Objective 1.4.1 and Objective 1.4.2: A better logistics system is constructed through e-commerce collaboration.

E-commerce emerges in the era of the internet. The e-commerce system is an open and complex dynamic system. The successful operation of e-commerce is the result of joint efforts, mutual collaboration and learning among all parties. Collaboration among and collaborative management of various parties is a prerequisite for the stable development of the e-commerce system. Therefore, in chapter five, based on the characteristics of e-commerce system and following the basic principles of collaborative management of e-commerce projects, this research introduces the idea of collaborative management into e-commerce management and e-commerce logistics system, and designs an e-commerce management system. In section 5.4, the collaborative theory is employed to integrate the businesses of the whole logistics process and to construct the framework of “platform plus supply chain”. That may help to solve the problem that the information communication is blocked or not in time due to the disconnection of the supply chain networks, so as to contribute to the construction of a better logistics system and make the logistics industry keep pace with the development of e-commerce.

The core of the design of an e-commerce collaborative management system is the construction of the logistics system. In chapter six, based on the collaborative theory, a radial-spoke logistics network logistics system is designed in this research and efficient transportation of goods is achieved through collaborative management of all parties, The big data platform is used to help to achieve collaboration among all parties involved in the supply chain, set up logistics nodes reasonably, and plan logistics activities. By setting e-commerce hub, e-commerce regional distribution centres, e-commerce physical stores and e-commerce cooperatives, the industrial resources are integrated to achieve centralized transportation of e-commerce goods, thereby reducing redundant links and gaining economies of scale. In this way, the e-commerce logistics featuring low cost and high-quality services takes shape. At the same time, the layout of the network hubs is designed scientifically and the area functions and logistics activities are planned reasonably to promote the collaboration among all parties. This research is aimed to ensure the smooth transportation of goods from the “first mile” delivery to the “last mile” delivery. Besides, it is expected to provide one-stop transportation and distribution services in China so that e-commerce may cover all around the country, thus laying a solid foundation for further expansion of e-commerce in the future.

The collaborative development of e-commerce is inseparable from the support of information platforms. Making full use of e-commerce's advantages in network big data is an important backing for the expansion of e-commerce platforms and the development of e-commerce logistics. In chapter eight, according to the collaborative theory, the thesis is committed to promote collaboration of the e-commerce and logistics systems so as to provide customers with an online shopping platform integrating e-commerce transactions and logistics distribution. Meanwhile， it is intended to integrate social logistics alliance, e-commerce business platform and internal management platform and combine collaborative theory with cloud platform in order to create an integrated, comprehensive and convenient information system, thereby promoting the information sharing and the connection and cooperation among all parties involved in the supply chain and providing a guarantee for the steady development of e-commerce systems.

Conclusion 2 targets Research Objective 1.4.3: Standard LCL boxes are designed and drop-and-pull transport is adopted.

The infrastructure and facilities are very important for the logistics operation and it may determine the efficiency of logistics operations. In chapter seven, the goods logistics packaging specifications is designed according to the actual needs of loading as well as unloading and drop-and-pull transport,, and some infrastructure and facilities are transformed. The transformation targets the redesign and modification of the containers. The traditional containers is divided into four-stage standard LCL boxes, which may make the transportation of goods more convenient, save the loading space, reduce the empty load rate of the vehicles, and improve the sorting efficiency. At the same time, as part of the e-commerce collaboration, the four-stage standard LCL boxes can be better used with the help of the drop-and-pull transportation, which helps to improve the logistics efficiency and solve the problem of poor connection between trunk and feeder transport.

Conclusion 3 targets Research Objective 1.4.4: Logistics efficiency is to be improved.

The ultimate goal of this thesis is to better apply the e-commerce collaborative theory to the logistics system, thus reducing logistics costs and risks and improving logistics efficiency. In order to achieve this research objective, an e-commerce logistics system based on collaborative theory is established in chapter five, including designing the e-commerce collaborative system, promoting collaborative management mode, establishing a four-stage radial-spoke logistics network in chapter six, improving infrastructure and facilities in chapter seven and developing e-commerce big data platform in chapter eight. The collaboration among all parties involved in the e-commerce supply chain eliminates the time and spatial barriers and presents a solution to the first mile and the last mile delivery of the supply chain. The collaborative application of infrastructure and facilities and transportation methods reduces logistics operation costs and avoids redundant links. The perfect combination of cloud platform and collaborative theory not only promotes the effective management of information, but also ensures that information is communicated both correctly and in time in the whole process, thus avoiding the problem of “information island” and helping to shorten operation time and improve operation efficiency.

9.3 Contributions

In general, in order to achieve the ultimate objective of improving the efficiency of logistics operation, the main contribution of this thesis is to design an e-commerce logistics system from the perspective of collaborative theory.

The first chapter elaborates on the research background and significance of the establishment of an e-commerce logistics system under the collaborative theory, introduces the classification of e-commerce, analyses the development status and trend of e-commerce and e-commerce logistics, and then draws forth the research direction of this thesis. The novelty is that based on the theory of collaborative management, a radial-spoke logistics system is proposed. Through the e-commerce collaborative management framework, the design of standard LCL boxes, drop-and-pull transportation, and the establishment of a cloud platform, the e-commerce collaborative theory is well applied to the logistics system, thus reducing logistics costs and improving logistics efficiency while expanding e-commerce.

The second chapter comprehensively analyses literature both at home in China and abroad from four aspects: e-commerce collaborative theory, e-commerce logistics system, e-commerce information network platform, and e-commerce logistics network. It elaborates the current situation of logistics system and logistics supporting e-commerce under collaborative management, analyzes and summarizes the essence and limitations of the research on collaborative theory, e-commerce and logistics system. The research is carried out based on these theories and in view of the shortcomings of the current research.

The third chapter introduces the six research methods employed in the thesis. The research combines qualitative research and quantitative research to ensure the feasibility and scientificity of the research, which also provides reference for further study in the research method.

The fourth chapter provides the theoretical support to the thesis. It introduces the definitions, features and rationales of systems and systems engineering, collaborative theory, and project management theory, and refines and summarizes the research opinions of scholars both at home in China and abroad, forming a complete theoretical system which provides the theoretical basis for the following e-commerce collaborative theory, the e-commerce and e-commerce logistics collaborative management, the design of e-commerce logistics system, the application of standard LCL boxes and drop-and-pull transportation, and the establishment of a cloud platform. At the same time, in terms of theory, it has made some contributions to the future research of scholars.

In Chapter five, the research establishes a conceptual model for collaborative management of e-commerce projects, and the novelty is to design e-commerce collaborative management framework and propose a system concept and method for collaborative management of e-commerce and e-commerce logistics. Then, based on collaborative theory, it integrates the supply chain business processes, designs the logistics network, improves facilities and equipment, and builds a "platform plus supply chain" framework. At the same time, the cloud platform and the collaborative theory are perfectly combined to improve the information platform. The whole logistics network combines with the big data analysis of the online cloud platform from the collaborative theory, so as to make great contributions to achieve a seamless connection of all parties involved in the supply chain, bridging the time and space gaps of e-commerce, solving the problems in first mile and the last mile delivery and realizing real-time interaction of information. Furthermore, through the analysis of the e-commerce logistics collaborative management and the importance of e-commerce logistics, it promotes the better application of the e-commerce collaboration theory to the logistics system to reduce logistics costs and improve logistics operation efficiency.

The sixth chapter, based on the e-commerce logistics collaborative management theory, further perfects the design of e-commerce collaborative logistics system. A four-stage radical-spoke logistics network is designed including the e-commerce hub, e-commerce regional distribution centers, e-commerce physical stores, and e-commerce cooperatives. The functions and layout of the network hub are reasonably planned to efficiently complete the entire delivery process of e-commerce goods from "first mile" to "last mile" delivery. The four-stage radical-and-spoke logistics operation mode connects the whole supply chain, the design of a novel logistics network and operation mode promotes collaborative operation and interconnection among all parties involved in the supply chain, truly bridges the "first mile" and "last mile" delivery to the whole process, thus promoting the development nationwide one-stop e-commerce distribution services. The design of the whole logistics system efficiently integrates industrial resources, creates scale economies through the centralized transportation of products and goods, and meets the major requirements of "convenience", "high efficiency", and "low cost" for logistics distribution. The smooth operation of the entire system not only makes an important contribution to improve logistics efficiency and greatly save time for e-commerce logistics, but also lay a good foundation for e-commerce collaborative operation, which is also the most representative contribution of the study to e-commerce logistics and e-commerce.

The seventh chapter focused on the improvement of facilities and equipment. The design idea behind 40-foot standard containers is drawn on, and the innovative point is that conventional containers are differentiated and divided into four stages, and four series of standard LCL boxes are designed considering the specifications of transport vehicles and logistics packaging, etc. The novel design not only avoids repeated sorting, improves sorting efficiency, but also facilitates the seamless transportation of goods at logistics nodes. Meanwhile, the boxes are redesigned from the details to make the transportation of goods more convenient, facilitate logistics operation, and improve operating efficiency. Furthermore, through the perfect combination of standard LCL boxes and drop-and-dull transportation, the utilization rate of standard LCL boxes is effectively improved. The standard LCL boxes schemes for line haul and feeder transportation are designed by employing simulations method, to maximize the volume utilization ratio and the weight-loss rate of cold boxes, which also verified the rationality of the standard LCL boxes and made important contributions to the improvement of facilities and equipment and the connection of drop-and-pull transport in the logistics system.

Chapter eight will help to improve and develop the network big data platform based on the existing network platform of e-commerce, and help to build a cloud platform based on the collaborative theory to realize innovation and development of the information platform. The platform focuses on optimizing the network platform, and integrates logistics alliance with management systems to create an integrated, comprehensive, convenient information system with the consideration of both internal and external elements. The logistics alliance integrates the businesses of the enterprises with the idle resources in society so that the enterprises may easily expand their business scope. The management system integrates the vehicle dispatching platform, the warehouse visible board system, and the e-commerce cloud platform to ensure the integrity of information and the visualization of transportation, and promote information sharing among all parties involved in the supply chain and break the barriers caused time and space. Through the collaborative operation of the transportation platform and the logistics system, effective management of increasing information is realized, so that the information between each operation link is exchanged and communicated in a timely and accurate manner, and the logistics operation efficiency is improved. The beauty of this platform is to integrate multiple functions on the network platform and realise the interconnection of multiple interfaces, thus avoiding multi-party operation and the phenomenon of “information islands”. The construction of the entire cloud platform has made important contributions to the daily operation and future development of enterprise.

The four-stage radial-spoke network proposed in this thesis helps to solve the problems in the first-mile and last-mile delivery and lays a solid foundation for thee-commerce collaboration. The construction of the logistics network presents a way out of the straits of poor performance of line haul transportation in some areas. Simultaneously, with the help of the transformation of existing standard boxes, unnecessary sorting can be avoided, operational costs can be lowered, logistics time can be saved, and logistics efficiency can be improved through the standardisation of LCL boxes, thereby improving customer satisfaction with e-commerce services. Finally, the former e-commerce platform will be upgraded, and the collaborative theory can be better applied through the introduction of big data.

Essentially, this research makes the following contributions also with real world practical implications::

(1) The construction analysis and evaluation of the collaborative logistics network will completely connect the “first-mile” and “last-mile” distribution to the logistics chain and bring in high-end logistics value-added services such as e-commerce, supply chain finance, as well as logistics and trade integration.

(2) It will strengthen the upstream and downstream strategic cooperation and resources integration, and actively improve logistics network and terminal sales.

(3) It will gradually expand the influence of the one-stop supply chain and improve the road logistics network in China. This will enable the terminal network to reach villages and community convenience stores. With the transformation of old warehouses, the use of internal high technologies and the reconstruction of the logistics and transportation network, the layout of the e-commerce network becomes more complete and services become more comprehensive and satisfactory. This will satisfy more sales demands of various enterprises. Meanwhile, it will be more adaptable and predictable to set up warehouse outlets in the future.

(4) It will further enhance the intension of drop-and-pull transport to promote the establishment of a relatively complete national transportation network and guide the cooperation between transportation enterprises. While continuously satisfying the needs of individualised transportation services of manufacturers, the collaborative logistics network will effectively integrate logistics resources to achieve the best result of the whole supply chain.

(5) With the gradual development of technology, the transportation sub-systems in urban distribution and terminal distribution will be upgraded, GPS technology will be widely applied and efforts will be made to support two-way transportation business.

(6) The upgrading of the transportation system enables e-commerce enterprises to meet customers' requirement of having real-time access to information about goods on transportation. In addition, real-time information is provided for continuous replenishment, thus improving the ability of enterprises to provide personalised services.

(7) The information system platform is improved, the interface between the new system and the former system is emphasized and the growing information is effectively managed. That will achieve timely and accurate exchange of information, provide timely and correct decision-making information and decision support, shorten the operation time of standard boxes and improve operational efficiency. All these efforts are made to improve customer satisfaction, enhance the competitiveness of enterprises and further improve the operation and management of enterprises.

(8) The design structure matrix is a brand-new tool for the collaborative system design model. Compared with the traditional system model design tool, the design structure matrix is able to clearly show the logical relationship among the various elements of the system. The optimization model is extracted from complex engineering problems and a reasonable optimization process is given. Therefore, it can not only describe the structure of the system and the relevance of system elements in a simple and compact way, but also present complex system engineering elements in a matrix, more intuitively and visually showing the forward flow from the upstream activity to the downstream activity and the feedback flow from the downstream activity to the upstream activity.

In this thesis, the design theory of collaborative system based on DSM is to take advantage of the characteristics of DSM, deeply explore the collaborative relationship of all parties involved in the supply chain in the collaborative management framework of e-commerce, and reflect the integration and optimization of logistics links in the DSM matrix, so as to obtain the collaborative relationship among the elements in the four-stage radial-spoke logistics network. The DSM matrix clearly shows the operation of the five elements of the information platform, e-commerce regional distribution centers, e-commerce hub, chain stores and convenience stores and also more clearly express the optimization process of e-commerce logistics system.

In short, this thesis made great contributions in terms of the innovation and development of logistics model: proposing a "collaborative distribution" model, optimizing the internal and external resources of e-commerce enterprises, integrating logistics business processes, designing a four-stage radial-spoke logistics network, and connecting the "first-mile" and "last-mile" delivery with the supply chain, and providing one-stop transportation and distribution services in China. Based on the collaborative theory, it attempts to upgrade facilities and equipment and improve the information, which not only reduces the logistics operation process and costs, but also improves the logistics operation efficiency.

Based on collaborative theory and following the basic principles of e-commerce project collaborative management, the thesis establishes a framework of e-commerce management so as to promote e-commerce collaboration theory and meanwhile enhance the collaboration of e-commerce operation. In this framework, enterprises are suggested to build logistics systems based on their own characteristics, and the combination of collaborative management and big data platform is emphasized. As for the construction of logistics system, it designs a four-stage radial-spoke logistics network involving the e-commerce hub, the e-commerce regional distribution centers, chain stores and convenience stores, which connects the whole supply chain, helps to achieve the efficient transport of goods through the collaborative operation of all parties involved in the supply chain, and meanwhile solves the problems in the last-mile delivery. Besides, the network layout is optimized and the facilities and equipment as well as the mode of transport are improved. Meanwhile, this network makes use of the the advantages of big data platforms to create a convenient and efficient information system, which not only removes the time and space obstacles in the logistics process and improves logistics efficiency, but also reduces redundancy of supply chain and integrates industrial resources in an efficient way. In this way, the whole e-commerce supply chain is well-connected and meets the major requirements of convenience, efficiency, and cheapness for logistics delivery.

9.4 Some limitations of the study and prospects

China is a large country with a long history. Its diverse topography and large population bring about the fact that all areas develop at different pace. Therefore, it is hard to take all economic, political, transportation, geographic and other factors in the construction of e-commerce logistics system into consideration. The logistics system proposed in this thesis remains to be further tested by practice, and the development mode of e-commerce logistics should be selected according to specific local conditions.

Based on the status quo investigation, the research proposes a framework for the construction of e-commerce logistics system from the collaborative perspective, and puts forward some theoretically feasible methods to solve problems. The future research may focus on the more detailed practical application of this logistics system. It is expected to further improve this system by finding problems and gaining feedback information in practice, so as to promote the continuous development of e-commerce logistics.

In order to verify the feasibility of the model, the fuzzy comprehensive evaluation model is employed to select evaluation indexes to conduct performance evaluation and risk assessment. Various performance indexes are quantitative (such as transportation costs or storage costs) or qualitative (such as product quality or market adaptability). Various risk assessment indexes include operational organisation, technology and equipment, hub, level of information application, and policies and measures. After determining the indexes, it is necessary to determine different index quantization methods according to different properties of the indexes. Then, the evaluation values of these indexes are set to form a remark set and through the non-dimensionalisation of indexes, the attribution of each single index to each evaluation value (called fuzzy matrix) is calculated. Finally, according to the weight allocation of each index in the evaluation target, the quantitative solution of the evaluation is obtained through data processing and calculation. Through performance evaluation and risk assessment, it is concluded that the evaluation result of logistics optimization program is of a better grade, and the operational risk is relatively low.

With the deepening of economic globalization and the development of information technology, e-commerce, as a newly-flourished business, is penetrating all sectors of the national economy, becoming an important economic growth point and new field in the market economy, with irreplaceable advantages. Traditional business enterprises have also seized opportunities to actively develop the e-commerce market and promote the expansion of e-commerce. Therefore, the potential and importance of e-commerce development were emphasized in related articles published over the past five years and also validated in this thesis.

However, e-commerce is a complex system project, so how to make this dynamic and large system operate efficiently and smoothly is an urgent problem. Therefore, future research should pay more attention to exploring its competitive advantages in a systematic way, tapping potential values, and promoting e-commerce companies to move forward steadily in the tide of the times.

In addition, under the influence of the general trend of global informatization, the competition of the e-commerce enterprise is becoming increasingly fierce, so more and more enterprises begin to realize the superiority of the collaborative operation of e-commerce systems and purposely apply the collaborative theory to the integration of the internal and external enterprises resources. However, the collaborative operation of e-commerce system is a dynamic process that needs to be continuously improved in the long term. Therefore, future research should view the application of collaborative theory to e-commerce system with a comprehensive, developmental and holistic eye. And it should use system ideas to find corresponding strategies in view of various existing problems, and it should, on this basis, promote the collaboration of logistics resources, enterprise resources, capital flows and information sharing. Furthermore, collaborative management of e-commerce systems is a dynamic process based on the blend of multiple disciplines and technologies, involving multi-party theories such as e-commerce, collaboration, management, and system engineering, and with various factors mutually affecting each other. Future related research should be carried out based on system ideas. At the same time, as an emerging management method, e-commerce collaborative management should keep pace with the times, continuously improve and innovate, so as to take the collaborative management framework of e-commerce system to a new level.

REFERENCES

Abbad, H. (2013). Silogin 2013 information systems, logistics, and innovation: a clash of theories. Supply Chain Forum An International Journal, 14(4), 2-3.

Akanbi, C. T., & Oludemi, F. O. (2004). Effect of processing and packaging on the lycopene content of tomato products. International Journal of Food Properties, 7(1), 139-152.

Akinola Adetola Akinyemi. (2014). Project life cycle, 13(7), págs. 495-503.

Akter, S., & Wamba, S. F. (2016). Big data analytics in e-commerce: a systematic review and agenda for future research. Electronic Markets, 26(2), 173-194.

Akyelken, N. (2016). Green logistics: improving the environmental sustainability of logistics. Transport Reviews, 31(31), 547-548.

Alaa, G., & Fitzgerald, G. (2004). A Proposal of an Upfront Requirements Modeling and Design Practice for e-Commerce Projects. Hawaii International Conference on System Sciences.

Albaugh, V. A., Chang, Y. T., & Haranath, M. H. (2001). System and method for binding processes in an e-commerce hub.

Albers, S., & Brekalo, L. (2016). Effective logistics alliance design and management. Working Paper, 18(2).

Alchian, A. A., & Demsetz, H. (1972). Production, information costs, and economic organization. IEEE Engineering Management Review, 62(5), 777-795.

Al-Nawayseh, M. K., Alnabhan, M. M., Al-Debei, M. M., & Balachandran, W. (2013). An adaptive decision support system for last mile logistics in e-commerce: a study on online grocery shopping. International Journal of Decision Support System Technology, 5(1), 40-65.

Allen, J., Browne, M., & Cherrett, T. (2012). Investigating relationships between road freight transport, facility location, logistics management and urban form. Journal of Transport Geography, 24(4), 45-57.

Anderson, D., & Lee, H. (1999). Synchronized supply chains: the new frontier. D Anderson Achieving Supply Chain Excellence Through Technology, 44(4), págs. 12-18.

Anderson, D., & Walter, P. (1999). Blobel's nobel: a vision validated. Cell,99(6), 557-8.

Anderson, J., Newton, C. J., & Tai, H. N. (2014). Virtual path group protection switching — a method for fast atm network survivability. Bell Labs Technical Journal, 2(2), 213-233.

Ángel Herrero Crespo, & Bosque, I. R. D. (2008). The effect of innovativeness on the adoption of b2c e-commerce: a model based on the theory of planned behaviour. Computers in Human Behavior, 24(6), 2830-2847.

Ansell, C., & Gash, A. (2008). Collaborative governance in theory and practice. Journal of Public Administration Research & Theory, 18(4), 543-571(29).

Antoni Lluís Mesquida, Antònia Mas, Marion Lepmets, & Alain Renault. (2014). Development of the project management spice (PMSPICE) framework.

Arnold, U., Oberländer, J., & Schwarzbach, B. (2012). LOGICAL — Development of cloud computing platforms and tools for logistics hubs and communities. Computer Science & Information Systems.

Asano, K., & Yamazaki, K. (2013). Observation Analysis Method for Culture Centered Design – Proposal of KH Method –. International Conference on Design.

Austan D. Goolsbee, & Peter J. Klenow. (2018). Internet rising, prices falling: measuring inflation in a world of e-commerce. austan goolsbee.

Ayral, X., Baron, G., Ravaud, P., Breban, M., & Dougados, M. (2002). The impact of e-commerce on agro-food marketing: the case of agricultural cooperatives, firms and consumers in crete. British Food Journal, volume 104(8), 580-590(11).

Babur, De, Los, Santos, Ali, & Hortaçsu. (2017). Search with learning for differentiated products: evidence from e-commerce. Journal of Business & Economic Statistics.

Baccarini, D. (1996). The concept of project complexity—a review. International Journal of Project Management, 14(4), 201-204.

Bai, I. (2007). Collaborative theory and management collaborative theory. Gansu Social Science, 2007(5), 228-230.

Bai, S., & Lin, Z. (2010). Quality Supervision in Logistics Service Supply Chain under Asymmetric Information Based on Game Theory. Proceedings of 2010 Chinese Control and Decision Conference.

Bai, X. (2017). Research on credit evaluation model of c to c e-commerce based on trust influence factors. Journal of Computational & Theoretical Nanoscience.

Balakrishnan, A., & Geunes, J. (2010). Collaboration and coordination in supply chain management and e-commerce. Production & Operations Management, 13(1), 1-2.

Bambang Trigunarsyah, Mehran Zeynalian, & H R Ronagh. (2013). Modification of advanced programmatic risk analysis and management model for the whole project life cycle's risks. Journal of Construction Engineering and Management, 139(1), 51-59.

Bandrauk, A., Delfour, M. C., & Bris, C. L. (2004). Managerial knowledge to organisational capability: new e-commerce businesses. Journal of Intellectual Capital, volume 5(2), 326-336(11).

Barcelos, V. P., Amarante, T. C., Drury, C. D., & Correia, L. H. A. (2014). Vehicle monitoring system using IEEE 802.11p device and Android application. Computers & Communication.

Baxter, S., Muir, D., Brereton, L., Allmark, C., Barber, R., & Harris, L., et al. (2016). Evaluating public involvement in research design and grant development: using a qualitative document analysis method to analyse an award scheme for researchers. Research Involvement & Engagement, 2(1), 1-15.

Bayles, D. L., & Bhatia, H. (2001). E-commerce logistics & fulfillment: delivering the goods. Prentice Hall.

Bennett, A. F. (1991). The evolution of active capacity. Journal of Experimental Biology, 160, 1-23.

Bensassi, S., Márquez-Ramos, L., Martínez-Zarzoso, I., & Suárez-Burguet, C. (2015). Relationship between logistics infrastructure and trade: evidence from spanish regional exports. Transportation Research Part A, 72(72), 47-61

Bergamaschi, S., Gelati, G. , Guerra, F. , & Vincini, M. . (2006). An intelligent data integration approach for collaborative project management in virtual

enterprises. World Wide Web,9(1), 35-61.

Berger, J. (2014). A guide to third generation coaching : narrative-collaborative theory and practice.

Bertalanffy, L. V. (1950). An outline of general system theory. British Journal for the Philosophy of Science, 1(2), 134-165.

Bhise, V. D. (2016). Designing complex products with systems engineering processes and techniques. Production Planning & Control, 27(12), 1039-1039.

Bi, D., & Qiu, C. (2014). Research on the influence mechanism of B2C e-commerce enterprise-customer interaction on customer experience. Chinese Soft Science (12), 124-135.

Bingyi, L. (2016). Creating a new journey for third-party logistics - Interview with Professor Chu Xueyu, Director of Zheng Ming Modern Logistics Research Institute. China Storage and Transportation (6), 32-35.

Bingyi, L. (2016). Large-scale intensification and peer cooperation - Shanghai Zhengming Modern Logistics Co., Ltd.. China Storage and Transportation (5), 37-38

Birry, L., Leclerc, S., & Poirier, S. (2016). The LCL&L Process: A Sustainable Solution for the Treatment and Recycling of Spent Potlining. Light Metals 2016.

Blanchard, B. S. (1988). The Measures Of A System-Performance, Life-Cycle Cost, System Effectiveness, Or What?. Aerospace & Electronics Conference.

Blanchard, B. S. (2008). System engineering management, 4th edition.

Briantono, O. , & Kurniawan, I. . (2019). Collaboration of web design and e-commerce as a local product marketing weapon. IOP Conference Series Materials ence and Engineering, 662, 032001.

Bo, Z., Zhang, H., & Liu, B. (2010). To promote the development of retail E-Commerce in depth with regional E-Commerce. Second International Seminar on Business & Information Management.

Boehm, B., & Valerdi, R. (2010). The roi of systems engineering: some quantitative results. Systems Engineering, 11(3), 221-234.

Bottero, M., Chiara, B. D., & Deflorio, F. P. (2013). Wireless sensor networks for traffic monitoring in a logistic centre. Tramsportation Research Part C Emerging Technologies, 26(1), 99-124.

Bouchelligua, W., Mahfoudhi, A., Mezhoudi, N., Daassi, O., & Abed, M. (2010). User interfaces modelling of workflow information systems.

Bowen, G. A. (2013). Document analysis as a qualitative research method. Qualitative Research Journal, 9(2), 27-40.

Brekalo, L., Albers, Sascha, & Delfmann, Werner. (2013). Logistics alliance management capabilities: where are they?. International Journal of Physical Distribution & Logistics Management, 43(7), 529-543.

Brown, H. R., Zeidman, P., Smittenaar, P., Adams, R. A., Mcnab, F., & Rutledge, R. B., et al. (2014). Crowdsourcing for cognitive science – the utility of smartphones. Plos One, 9(7), e100662.

Brusa, E. , Ambra Calà, & Ferretto, D. . (2018). The Methodology of Systems Engineering. Systems Engineering and Its Application to Industrial Product Development.

Burdea, G., & Coiffet, P. (2015). Virtual reality technology. Digital Technology & Application, 95(6), 663-664.

Cai, F., Li, Jin, & Cui, Jian. (2011). Construction of vehicle dispatching service system based on gis. Applied Mechanics & Materials, 90-93(6), 3314-3317.

Cai, W., & Huang, D. (2014). Research on Optimization of Terminal Distribution of E-commerce Logistics Based on toc Theory. Knowledge economy (22), 87-88.

Calderwood, E. (2016). Coping with change: the implications of e-commerce adoption for island consumers. Regional Studies, 50(5), 894-908.

Cano, I., & Torra, V. (2009). Container Loading for Nonorthogonal Objects with Stability and Load Bearing Strength Compliance. Logistics & Industrial Informatics, Lindi International.

Cao, K. , & Yang, Z. . (2016). A study of e-commerce adoption by tourism websites in china. Journal of Destination Marketing & Management, S2212571X16000068.

Cattell, K. S. (2002). Foresight, space and e - commerce. Facilities,20(3/4), 145-162.

Cavalieri, S., & Pezzotta, G. (2012). Product–service systems engineering: state of the art and research challenges. Computers in Industry, 63(4), 278-288.

Cavalcante, E., Lopes, F., Batista, T., Cacho, N., Delicato, F. C., & Pires, P. F. (2011). Cloud Integrator: Building Value-Added Services on the Cloud. First International Symposium on Network Cloud Computing & Applications.

Ceara Hatton, M. A. O., Sarre, P. S. P., Timbarlake, L. T. L., Liboreiro, E., Pomareda Benel, C., & Garcíapelayo, y. G. R., et al. (1989). Studies in the processing, marketing and distribution of commodities: the marketing of bovine meat and products: areas for international co-operation. COMERCIO INTERNACIONAL;.

Čedomir Ivaković, Šafran, M., & Rogić, K. (2012). Logistics as element of improvements in storage, distribution and transportation of goods. Promet-Traffic-Traffico, 12(6), 157-162.

Chakraborty, P. S., Tiwari, Arti, & Sinha, Pranshu Raj. (2015). Adaptive and optimized emergency vehicle dispatching algorithm for intelligent traffic management system. Procedia Computer Science, 57, 1384-1393.

Chang, P. Y., Chen, K., & Lin, H. Y. (2010). Determining optimal convenient store location in logistics network with consideration of transshipment cost. International Conference on Computers & Industrial Engineering.

Chang, Sh. (2011). From classical system theory to modern system theory. Journal of Systems Science (3), 1-4.

Changyu, Jiale, & Jing. (2015). Rural e-commerce and new model of rural development in china:a comparative study of "taobao village" in jiangsu province. Asian Agricultural Research(11), 35-37.

Chao Tu, Mingke He, Ye Ren, & Yao Qin. (2018). Research on the Logistics Embeddedness in Rural Town E-commerce. Proceedings of the Fifth International Forum on Decision Sciences.

Cheah, W. S., Masli, A. B., & Mit, E. (2014). Sustainability Modelling of e-Commerce for Rural Community: A Case from Long Lamai e-Commerce Initiative. International Conference on Informatics & Creative Multimedia.

Chen, D. (2009). Innovation of Tourism Supply Chain Management. International Conference on Management of E-commerce & E-government.

Chen, D., & Chen, J. (2010). Research of JIT Distribution Center Location for Regional E-Supermarket in Ring-like Area. International Conference on E-business & E-government.

Chen, D., Qiu, D., Guo, H., & Liang, Q. (2015). Cooperatives conduct comparative analysis of e-commerce models. Chinese Farmers Cooperative (7), 25-26.

Chen, D., Zhu, X., Bing, T., Shen, X., & Tao, F. (2011). The Design of Logistics Information Matching Platform for Highway Transportation. Intelligent Computing and Information Science.

Chen, Fang, Nunamaker, Jay, F., Briggs, & Robert, O., et al. (2014). An application of focus theory to project management processes. Group Decision & Negotiation, 23(5), 961-978.

Chen, G., & Ju, Ch. (2011). A new task planning method based on design structure matrix. Computer integrated manufacturing system, 17(7), 1366-1373.

Chen, H. (2010). Construction on logistics service quality system of chain convenience stores. International Conference on Logistics Systems & Intelligent Management.

Chen, H., Chen, H., & Yang, L. (2011). Research and design of project management system for scientific research. Computer knowledge and technology, 07(10), 2217-2219.

CHEN Hua. (2013). Design and implementation of logistics information platform based on cloud computing. Computer & Modernization.

Chen, J. (2014). Research on the e-commerce model of small and medium enterprises. Applied Mechanics & Materials, 687-691(20), 2019-2022.

Chen, L., Hou, G., & Zhang, Y. (2012). Application of collaborative optimization theory to multiple damage model of structure. Shipbuilding of China.

Chen, M. (2012). Construction of microfinance e-commerce platform. (Doctoral dissertation, Hunan University).

Chen, M. (2014). Improved genetic algorithm for emergency logistics distribution vehicle routing problems. International Conference on Security.

Chen, M., Shen, W., Tang, P., & Zuo, S. (2018). Optimal vehicle dispatching schemes via dynamic pricing.

Chen, Q., & Dayal, U. (2000). Multi-agent Cooperative Transactions for E-Commerce. Cooperative Information Systems.

Chen, Q., Hsu, M., & Kleyner, I. (2001). How agents from different e-commerce enterprises cooperate. International Symposium on Autonomous Decentralized Systems.

Chen, T., Lu, Y., & Wu, Z. (2013). Construction of Evaluation Indexes System for Collaborative Development Maturity Oriented to the IOT Industry. Fourth International Conference on System Science.

Chen, X., & Lin, H. (2013). Research on e-commerce logistics system informationization in chain ☆. Procedia - Social and Behavioral Sciences, 96(13), 838-843.

Chen, Y. (2010). Analysis of the Impact of e-commerce on logistics. Career (15), 115-117.

Chen, Zh. (2017). Research on the e-commerce mode of farmers' professional cooperatives under the background of Internet +. Modern marketing (late issue) (5), 136-136.

Chirkin, K., Penikas, H., & Privalova, E. (2014). Global internet activity and e-commerce survey. Ssrn Electronic Journal.

Cho, S., Lee, S., & Yun, J. (2011). A method of detection and analysis of logistics information error on B2B supply chain. Wseas International Conference on System Science & Simulation in Engineering.

Choi, T. M., Chiu, C. H., & Chan, H. K. (2016). Risk management of logistics systems. Transportation Research Part E Logistics & Transportation Review, 90, 1-6.

Chow, H. K. H., Choy, K. L., Lee, W. B., & Chan, F. T. S. (2007). Integration of web - based and rfid technology in visualizing logistics operations – a case study. Supply Chain Management, 12(3), 221-234.

Chueh, H. E., Kao, C. Y., & Fahn, C. S. (2011). Constructing a transportation service platform through integrating gps and optimized dispatching mechanism. Advanced Materials Research, 314-316, 2060-2063.

Clarke, S., Oades, L. G., Crowe, T. P., & Deane, F. P. (2006). Collaborative goal technology: theory & practice. Faculty of Health and Behavioural Sciences - Papers.

Coelho, T. M., Castro, R., & Jr, J. A. G. (2011). Pet containers in brazil: opportunities and challenges of a logistics model for post-consumer waste recycling. Resources Conservation & Recycling, 55(3), 291-299.

Colfer, C. J. P., Hartanto, H., Jum, C. N., Mcdougall, C., Prabhu, R., & Yuliani, L. (2005). Adaptive collaborative management. Participatory Research and Development for Sustainable Agriculture and Natural Resource Management: A Sourcebook.

Cong, L. (2010). Review of scalability problem in e-commerce collaborative filtering. New Technology of Library & Information Service.

Córdova, J., Merchán, D., & Torres, S. (2014). Redesigning a retail distribution network in restricted urban areas: a case study on beverage distribution in the historic center of quito. Journal of Applied Research & Technology, 12(5), 850-859.

Couture, V., Faber, B., Gu, Y., & Liu, L. (2018). E-commerce integration and economic development: evidence from china. Social Science Electronic Publishing.

Colla, E., & Lapoule, P. (2013). E - commerce: exploring the critical success factors. International Journal of Retail & Distribution Management, 40(11), 842-864(23).

Conforto, E. C., Amaral, D. C., Silva, S. L. D., Felippo, A. D., & Kamikawachi, D. S. L. (2016). The agility construct on project management theory. International Journal of Project Management, 34(4), 660-674.

Couture, V. , Faber, B. , Gu, Y. , & Liu, L. . (2018). E-commerce integration and economic development: evidence from china. CEPR Discussion Papers.

Cordeiro, W. P. (2003). A case study: how a retail jewelry store learned to compete in the e-commerce market place. Journal of Internet Commerce,2(1), 19-28.

Cortez, V., Lopez, B., Whyborn, N., Price, R., Hernandez, O., & Gairing, S., et al. (2016). Problem reporting and tracking system: a systems engineering challenge

Cui, M. , Pan, S. L. , Newell, S. , & Cui, L. . (2017). Strategy, resource orchestration and e-commerce enabled social innovation in rural china. Information age, 26(1), 3-21.

Cui, Y., Cai, D., Shen, Sh., & Li, X. (2015). Design and implementation of intelligent self-reporting cabinet refrigeration control system. Electronic world (19), 92-95.

Dan, J. K., Song, Y. I., Braynov, S. B., & Rao, H. R. (2005). A multidimensional trust formation model in b-to-c e-commerce: a conceptual framework and content analyses of academia/practitioner perspectives. Decision Support Systems, 40(2), 143-165.

Dan, L., Liang, Z., Li, Y., & Han, Y. (2010). Research and design of a high performance GPS vehicle monitoring system. International Conference on Future Information Technology & Management Engineering.

Dan-Qing, D. U., Economics, S. O., & University, Z. G. (2015). The structural diversification of the retail market in the big data age:based on e-commerce industrial expansion. Journal of Business Economics(2), 12-17.

Dahmann, J., Rebovich, G., Lane, J. A., & Lowry, R. (2012). An implemented view of systems engineering for systems of systems. Aerospace & Electronic Systems Magazine IEEE, 27(5), 11-16.

Daim, T. U., Basoglu, N., Kargin, B., & Phan, K. (2014). Service innovation adoption: the case of value-added mobile services. Journal of the Knowledge Economy, 5(4), 784-802.

Daniluk, D., Wolf, M., Wolf, O., & Hompel, M. T. (2016). Logistics Mall—A Cloud Platform for Logistics. Logistics and Supply Chain Innovation.

Deng, H. F., Wen Deng, Han Li, & Hong-Ji Yang. (2010). Authentication and access control in rfid based logistics-customs clearance service platform. International Journal of Automation and Computing, 7(2), 180-189.

Deng, J., & Min, W. (2008). Fuzzy Integrated Evaluation of E-commerce Information System. International Symposium on Computer Science & Computational Technology.

Devaraj, S., Fan, M., & Kohli, R. (2002). Antecedents of b2c channel satisfaction and preference: validating e-commerce metrics. Information Systems Research, 13(3), 316-333.

Devari, A., Nikolaev, A. G., & He, Q. (2017). Crowdsourcing the last mile delivery of online orders by exploiting the social networks of retail store customers. Transportation Research Part E Logistics & Transportation Review, 105, 105-122.

Demiański, & Doroshkevich, A. G. (2004). Statistical characteristics of large scale structure. , 422(2), págs. 423-444.

Destouni, G., & Graham, W. (1997). The influence of observation method on local concentration statistics in the subsurface. Water Resources Research, 33(4), 663–676.

Dickinson, H., & Sullivan, H. (2014). Towards a general theory of collaborative performance: the importance of efficacy and agency. Public Administration, 92(1), 161-177.

Ding, L. (2017). Analysis on the mode of logistics distribution of B2C e-commerce enterprises. Technological innovation and application (2), 265-265.

Ding, Q., & Zhu, J. (2017). Product information traceability and anti-counterfeiting model of b2c e-commerce platform from the perspective of blockchain. China's circulation economy, 31(12), 41-49.

Ding, R. (2009). Summary of project management theory. Cooperative economy and technology (7), 50-51.

Ding, R., & Yang, L. (2008). The Researches of Agile Logistics System of Fresh Agricultural Products Based on E-commerce. International Conference on Information Management.

Dong, X. (2010). Construction of e-commerce enterprise collaborative logistics information platform. (Doctoral dissertation, Jilin University).

Dong, X. (2010). E-commerce enterprise collaborative logistics information platform construction. (Doctoral dissertation, Jilin University).

Dong, X. (2014). Analysis on the Status Quo and Problems of China's Logistics Self-proclaimed Service Development. Journal of Tianjin Vocational College of Business, 2(6), 20-23.

Dong, Y., & Zhu, Y. (2012). Discussion on farmers' professional cooperatives developing e-commerce of agricultural products. Zhejiang Agricultural Science, 1(2), 262-265.

Doumeingts, G., Ducq, Y., & Chen, D. (2009). System Theory to support Enterprise Interoperability Science Base. Technology Management Conference.

Du, J. (2002). Collaborative e-commerce: Business models in the 21st Century. Jiangxi Social Sciences, (9), 190-192.

Du, J. P., Li, Y., Shi, J. Y., Zhang, L. P., & Li, L. (2007). Compaison of monitored anesthesia care and spinal anesthesia during transurethral resection of the bladder tumors. China Journal of Endoscopy, 9, 033. Mc Ivor, A. (2005). Rethinking the principles of war. Naval Institute Press.

Du, Z. P., & Qi, F. Z. (2014). Bi-level programming model and solution algorithm for the location of e-business logistics distribution. Advanced Materials Research, 1030-1032, 2532-2537.

Duan, C., Lv, L., & Zou, X. (2013). The main problems and countermeasures faced by the current floating population in China——based on the analysis of the data of the sixth national census in 2010. Population Research, 37(2), 17-24.

Duan, S. (2018). Research of e-commerce logistics distribution information resource sharing platform. Modern marketing (late issue) (3).

Duan, Sh. (2018). Research on e-commerce logistics distribution information resource sharing platform. Modern marketing (late issue).

Duan, Y. (2014). Research on strategy of cracking e-commerce logistics bottleneck under collaborative theory. Chinese business theory (11X), 71-73.

Ducq, Y., Chen, D., & Doumeingts, G. (2012). A contribution of system theory to sustainable enterprise interoperability science base. Computers in Industry, 63(8), 844-857.

Ecosystem, C. R. B. (2016). Project management plan. , 58(1), 272–277.

Egger, F. N. (2000). "Trust me, I'm an online vendor":towards a model of trust for e-commerce system design. Chi 00 Extended Abstracts on Human Factors in Computing Systems.

Eschler, J., Taylor, H., & Palkar, S. (2015). Researching Dynamic Phenomena in Complex Organizations: Collaborative Practice Research with Theory Triangulation.

Eskerod, P., Huemann, M., & Ringhofer, C. (2015). Stakeholder inclusiveness: enriching project management with general stakeholder theory. Project Management Journal, 46(6), 42–53.

EVA, Z. 2017. E-commerce and its Impact on Logistics Requirements. Open Engineering, 7, 121-125.

Fan, L. (2013). Research on the Choice of Organization Mode of Automobile Transportation. (Doctoral dissertation, Southwest Jiaotong University).

Fan, Y. , Ju, J. , & Xiao, M. . (2016). Reputation premium and reputation management: evidence from the largest e-commerce platform in china. International Journal of Industrial Organization, 46(May), 63-76.

Fang, Y. , Qureshi, I. , Sun, H. , Mccole, P. , Ramsey, E. , & Lim, K. H. . (2014). Trust, satisfaction, and online repurchase intention : the moderating role of perceived effectiveness of e-commerce institutional mechanisms. MIS Quarterly, 38(2), 407-427.

Fei, L. (2015). Research on China's e-commerce microfinance model. (Doctoral dissertation, Huazhong Normal University).

Feng, L. (2016). Intelligent logistics and distribution system based on Internet of Things. IEEE Advanced Information Management, Communicates, Electronic & Automation Control Conference.

Fleischmann, M. (2003). Reverse logistics network structures and design. Social Science Electronic Publishing.

Flyvbjerg, B. (2013). From nobel prize to project management: getting risks right. Social Science Electronic Publishing, 37(3), 5-15.

Fong, B., & Fong, A. C. M. (2009). Effective strategic planning for successful e-commerce project completion and deployment. IEEE the International Conference on Industrial Engineering & Engineering Management.

Fong, B. C. M., Chan, C. H. Y., & Fong, A. C. M. (2000). Time-based management of project planning in e-commerce deployment. IEEE International Conference on Management of Innovation & Technology.

Forrester, J. W. 1994. System dynamics, systems thinking, and soft OR. System Dynamics Review, 10, 245-256.

Fu, R., Subramanian, A., & Venkateswaran, A. (2016). Project characteristics, incentives and team production. Management Science, 62(3), 150605095359008.

Fugui, Zh. (2017). Accelerator of supply chain finance into cold chain logistics. China Logistics and Purchasing (24), 114-114.

Fukue, Y., Masayuki, K., & Tsuda, K. (2004). Extracting Purchase Patterns in Convenience Store E-Commerce Market Using Customer Cube Analysis. Knowledge-based Intelligent Information & Engineering Systems, International Conference, Kes, Wellington, New Zealand, September.

Fusaro, R., Ferretto, D., & Viola, N. (2016). Model-Based Object-Oriented systems engineering methodology for the conceptual design of a hypersonic transportation system. IEEE International Symposium on Systems Engineering.

Gang, L. I., Liu, Y., Song, Y., & Yin, J. (2016). Visualization pretreatment method for electric power big data based on information fusion. Guangdong Electric Power.

Gao Yanjun, Madhu Reddy, & Bernard J. Jansen. (2016). Shop together, search together: collaborative e-commerce.

Gao, Q., & Huang, Y. (2017). Research on Problems and Countermeasures of Express Logistics Packaging. Light Industry Technology (10), 117-118.

Geerts, G. L. (2011). A design science research methodology and its application to accounting information systems research. International Journal of Accounting Information Systems, 12(2), 142-151.

Geman, H., & Scheiber, Matthias. (2017). Recent experiences of copper on the shanghai futures exchange: some lessons for warehouse monitoring. Resources Policy, 54, 130-136.

George E. Mobus, & Michael C. Kalton. (2015). Systems Engineering. Principles of Systems Science. Springer New York.

Gholamian, M. R. , & Taghanzadeh, A. H. . (2017). Integrated network design of wheat supply chain: a real case of iran. Computers and Electronics in Agriculture, 140, 139-147.

Giglio, D. (2014). Task scheduling for multiple forklift AGVs in distribution warehouses. Emerging Technology & Factory Automation.

Giuffrida, M., Mangiaracina, R., Perego, A., & Tumino, A. (2016). Logistics Solutions to Support Cross Border E-Commerce Towards China: The Case of the Apparel Industry. Workshop on Business Models and ICT Technologies for the Fashion Supply Chain.

Gleissner, H., & Femerling, J. C. (2013). Logistics Systems. Logistics.

Goh, J., & Hall, N. G. (2013). Total cost control in project management via satisficing. Management Science, forthcoming(6), 1354-1372.

Goh, M., & Ling, C. (2003). Logistics development in china. International Journal of Physical Distribution & Logistics Management, 33(33), 886-917.

Gokhale, A., Balasubramanian, K., Balasubramanian, J., Krishna, A., Edwards, G. T., & Deng, G., et al. (2003). Model driven middleware: a new paradigm for developing and provisioning distributed real-time and embedded applications. Science of Computer Programming, 73(1), 39–58.

Gonalves, R. , José Martins, Pereira, J. , Cota, M. , & Branco, F. . (2016). Promoting e-Commerce Software Platforms Adoption as a Means to Overcome Domestic Crises: The Cases of Portugal and Spain Approached from a Focus-Group Perspective. Trends and Applications in Software Engineering. Springer International Publishing.

Gong, X. Y., Bo-Hu, L. I., Chai, X. D., & Mu, G. U. (2014). Survey on big data platform technology. Journal of System Simulation.

Gourdin, K. N. (2006). Global logistics management : a competitive advantage for the 21st century / k.n. gourdin. Journal of Business Ethics(2), 239-241.

Gregor, S., & Hevner, A. R. (2013). Positioning and presenting design science research for maximum impact. Mis Quarterly, 37(2), 337-356.

Grbovic, M. , Radosavljevic, V. , Djuric, N. , Bhamidipati, N. , Savla, J. , & Bhagwan, V. , et al. (2016). E-commerce in your inbox: product recommendations at scale.

Grossmann, I. (2010). Enterprise-wide optimization: a new frontier in process systems engineering. Aiche Journal, 51(7), 1846-1857.

Gu, X., & Ding, C. (2011). On the theory and potential of LRU-MRU collaborative cache management. International Symposium on Memory Management.

Gu, X., & Ding, C. (2012). A generalized theory of collaborative caching. Acm Sigplan Notices, 47(11), 109-120.

Gu, X. (2002). Regional innovation system theory. (Doctoral dissertation, Sichuan University).

Gu, X., & Ding, C. (2012). A generalized theory of collaborative caching. Acm Sigplan Notices, 47(11), 109-120.

Guangming,H. (2006). Discussed shallowly the manufacture enterprise electronic monitoring system management, at the right moment supp lies goods and the zero stock. China Water Transport: Theoretical Edition,4(11), 169-171.

Gudehus, T., & Kotzab, H. (2012). Comprehensive Logistics.

Guo, P. C., Wei, L., Chang, W. X., & Zhou, J. Y. (2010). The Contribution of Logistics Industry to Economic Growth Based on Logis Model. International Conference of Information Science & Management Engineering.

Guo, Y., Cheng, X., Dong, D., Luo, C., & Wang, R. (2010). An Improved Collaborative Filtering Algorithm Based on Trust in E-Commerce Recommendation Systems. International Conference on Management & Service Science.

Gupta, P. , & Sagar, B. B. . (2018). Usability Of An E-Commerce Website Using Information Mining and Artificial Intelligence. First International Conference on Information Technology & Knowledge Management.

Hake, H., Helbig, K., & Mesdag, C. S. (1984). Three-term taylor series for t2 - x2-curves of p- and s-waves over layered transversely isotropic ground. Geophysical Prospecting, 32(5), 828-850.

Haken. & Guo. Z. (1989). Advanced synergy. Science Press.

Haken, H. (1977). Synergetics : a workshop : proceedings of the International Workshop on Synergetics at Schloss Elmau, Bavaria, May 2-7, 1977.

Haken, H. (2000). Information and self-organization: a macroscopic approach to complex systems. Springer-Verlag New York, Inc.

Haken, H. (2018). Self-organization and information in biosystems: a case study. European Biophysics Journal, 47(4), 389-393. Haken, H., & Vallée, R. (2003). Synergetics and Cybernetics.Encyclopedia of Applied Physics. WILEY - VCH Verlag GmbH & Co KGaA.

Haken, H. (2004). Synergetics: introduction and advanced topics.Springer, 67(3), 773-774.

Hakey, P. M., Allis, D. G., Hudson, M. R., Ouellette, W., & Korter, T. M. (2012). Exploiting symmetries in logistics distribution planning. Chemphyschem, 10(14), 2434-2444.

Han,Meng. (2014). The design and implementation of e-commerce personalized services based on collaborative filtering recommendation system. Applied Mechanics and Materials, 687-691, 2039-2042.

Han, Zh. (2013). Research on b2c e-commerce logistics optimization under the new situation. Logistics technology, 32(5), 117-120.

Haoxue, L., Xun, Zh.,& Junru, Yang. (2006). Fuzzy synthetic evaluation model of transportation routes of dangerous goods. Journal of Transportation Engineering, 6(2), 80-82.

Hardy D. M. (2016). Project management—a science, an art or an organisation problem. Aeronautical Journal, 74(714), 469-471.

Hawk, S. (2004). A comparison of b2c e-commerce in developing countries. Electronic Commerce Research, 4(3), 181-199.

Hazen, B. T., & Byrd, T. A. (2012). Toward creating competitive advantage with logistics information technology. International Journal of Physical Distribution & Logistics Management, 42(1), 8-35.

He, F. (2014). Research on the Construction and Operation Mechanism of E-commerce Service Platform in Cloud Computing Environment. China E-commerce (12), 23-23.

Heeswijk, W. V., Mes, M., & Schutten, M. (2015). An Approximate Dynamic Programming Approach to Urban Freight Distribution with Batch Arrivals. International Conference on Computational Logistics.

Herrero Crespo, A., & Ignacio, R. D. B. (2010). The influence of the commercial features of the internet on the adoption of e-commerce by consumers. Electronic Commerce Research & Applications, 9(6), 562-575.

Herroelen, W., & Leus, R. (2005). Project scheduling under uncertainty: survey and research potentials. European Journal of Operational Research, 165(2), 289-306.

Heskett, J. L. (2013). Controlling customer logistics service. International Journal of Physical Distribution & Logistics Management, 1(3), 141-145.

Hill, J. A., Smith, B. E., Papoulias, P. G., & Andrews, P. C. (2010). Proteomecommons.org collaborative annotation and project management resource integrated with the tranche repository. Journal of Proteome Research, 9(6), 2809-11.

Hirsch, B. (2012). Integrating process modelling into multi-agent system engineering. Multiagent & Grid Systems, 8(1), 105-124.

Hjort, K. , & Lantz, B. . (2016). The impact of returns policies on profitability: a fashion e-commerce case. Journal of Business Research, S0148296316302272.

Hoek, R. I. V. (2013). From reversed logistics to green supply chains. Supply Chain Management, 4(3), 129-135.

Hong Jun Huang, Jun Yang, & Benrong Zheng. (2019). Demand effects of product similarity network in e-commerce platform. Electronic Commerce Research(2), 1-31.

Hong, W. , Zheng, C. , Wu, L. , & Pu, X. . (2019). Analyzing the relationship between consumer satisfaction and fresh e-commerce logistics service using text mining techniques. Sustainability, 11.

Holsapple, C. W., & Sasidharan, S. (2005). The dynamics of trust in b2c e-commerce: a research model and agenda. Information Systems and e-Business Management, 3(4), 377-403.

Holsapple, C. W., & Singh, M. (2015). Toward a unified view of electronic commerce, electronic business, and collaborative commerce: a knowledge management approach. Knowledge & Process Management, 7(3), 151-164.

Hou, Z. (2012). Quality Evaluation Model Study of B2C E-Commerce Website. Advances in Control and Communication.

Houde, JeanFrançois, Newberry, Peter, & Seim, Katja. (2017). Economies of density in e-commerce: a study of amazon's fulfillment center network. nber working papers.

Hristoski, I. S., & Mitrevski, P. J. (2017). Evaluation of business-oriented performance metrics in e-commerce using web-based simulation.

Hu, K. Y., & Chang, T. S. (2010). An innovative automated storage and retrieval system for b2c e-commerce logistics. International Journal of Advanced Manufacturing Technology, 48(1-4), 297-305.

Hu, J. (2018). E-commerce big data computing platform system based on distributed computing logistics information. Cluster Computing(99), 1-10.

Hu, Y. , Da, Q. , Zeng, A. , Yu, Y. , & Xu, Y. . (2018). Reinforcement learning to rank in e-commerce search engine: formalization, analysis, and application.

Hu, Z. H., & Sheng, Z. H. (2014). A decision support system for public logistics information service management and optimization. Decision Support Systems, 59(1), 219-229.

Hu, Zh, Gao., W., & Hu,H. (2015). A Feasibility Study on the Distribution Mode of Intelligent Self -extracting Cabinet with Customer Satisfaction. Logistics Engineering and Management (11), 168-170.

Hua-Ming, W. U., University, H., & University, Q. N. (2015). Strategic synergy based on self-organization:concept,features and management process. Chinese Journal of Systems Science.

Hua, P., & Sun, L. (2015). Dynamic Evaluation of Suppliers for Industrial Value Chain Value-Added Service Platform. Proceedings of the 4th International Conference on Computer Engineering and Networks.

Hua, W., & Jing, Z. (2015). An empirical study on e-commerce logistics service quality and customer satisfaction.

Hua, Zh. (2014). Design and implementation of P2P network lending e-commerce platform. (Doctoral dissertation, Hunan University).

Huang, C. C., Liang, W. Y., Lai, Y. H., & Lin, Y. C. (2010). The agent-based negotiation process for b2c e-commerce. Expert Systems with Applications, 37(1), 348-359.

Huang, L. J. (2014). The key technology research for logistics vehicle monitoring system based on gps. Advanced Materials Research, 1049-1050, 1189-1192.

Huang, L., Peng, Y., Luo, Q., & Yu, G. (2011). Construction of Chinese new rural e-commerce platform and its key technologies research based on double E-markets. International Conference on Mechatronic Science.

Huang, S. J. (2013). Qian xuesen's social engineering thought,method and its great significance. Journal of Renmin University of China.

Huang, Y. (2016). The case study of supplier certification index system in b2c e-commerce platform.

Huang, Y., Ye, W., & Wang, Q. (2014). Analysis of the relationship between the development of logistics industry and the evolution of global economic regions. Journal of the Chinese Institute of Industrial Engineers, 31(8), 471-476.

Hui, T. (2010). Design and Implementation of Vehicle Monitoring System Based on GSM/GIS/GPS. Second International Conference on Information Technology & Computer Science.

Hui, X. U., Liu, J. K., Zhou, Q., Lin, S., & Zheng, R. (2015). Assessment of power system black-start schemes based on improved analytic hierarchy process and fuzzy comprehensive evaluation. Journal of Electric Power, 1-6.

Huifeng. (2016). Review and prospective on systems engineering in china. Aerospace China, 17(1), 37-41.

Hsiao, Y. H., Chen, M. C., & Liao, W. C. (2017). Logistics service design for cross-border e-commerce using kansei engineering with text-mining-based online content analysis. Telematics & Informatics, 34, S0736585316303136.

Hwang, H. S. (2002). Design of supply-chain logistics system considering service level. Computers & Industrial Engineering, 43(1), 283-297.

Iannone, F. (2012). The private and social cost efficiency of port hinterland container distribution through a regional logistics system. Transportation Research Part A, 46(9), 1424-1448.

Ichoua, S., Gendreau, M., & Potvin, J. Y. (2006). Exploiting knowledge about future demands for real-time vehicle dispatching. Transportation Science, 40(2), 211-225.

Ishikawa, A., Amagasa, M., Shiga, T., Tomizawa, G., Tatsuta, R., & Mieno, H. (1993). The max-min delphi method and fuzzy delphi method via fuzzy integration ☆. Fuzzy Sets & Systems, 55(3), 241-253.

Issa, N., & Mohsen, K. . (2016). E-trust readiness indexes assessment at e-transactions in the context of b2c e-commerce. Indian Journal of Science & Technology, 9(2).

Iyer Karthik N. S, GermainN Richard, & CLAYCOMB Cindy. (2009). B2b e-commerce supply chain integration and performance: a contingency fit perspective on the role of environment. Information & Management,46(6), 313-322.

Jalali, A. A., Okhovvat, M. R., Okhovvat, M., Procs, J., Ict, R., & Ecommerce, et al. (2011). A new applicable model of iran rural e-commerce development. Procedia Computer Science, 3, 1157-1163.

Jané, J., & Ochoa, A. D. (2006). Contract to Provide Logistics Services: Warehousing and Resources. The Handbook of Logistics Contracts.

Jarrett, J. E. . (2016). Internet banking and e-commerce: a consumer perspective. Journal of Internet Banking & Commerce, 01(s2).

Jeffrey M. Keisler, & Robert F. Bordley. (2015). Project Management Decisions with Uncertain Targets.

Ji, X., & Ji, J. (2017). Research on China's b2c e-commerce logistics distribution mode under "Internet +". Heilongjiang animal husbandry and veterinary (8), 280-282.

Ji, Y., Xu, X., & Sun, Y. (2016). Cooperation strategies for e-commerce platforms with seller classification. Kybernetes, 45(9), 1369-1386.

Jia, D., Wen, H. Y., & Yang, Z. J. (2010). Research on data layer structure of multi-tenant e-commerce system. IEEE International Conference on Industrial Engineering & Engineering Management.

Jian-Feng, Q. , & Ying, J. . (2017). Development of novel fresh container with solar photovoltaic refrigeration technology. Journal of Harbin University of Commerce(Natural Sciences Edition).

Jian, L. I., Wang, B., Shi, H., & Lin-Lin, L. I. (2015). Manufacturer's buy-back policy in two-stage e-commerce supply chain with customer return policy. Computer Integrated Manufacturing Systems, 21(4), 1089-1100.

Jian, Z., Sha, Y., & Yan, J. (2012). Design and Implementation of Logistics Vehicle Monitoring System Based on the SaaS Model. Fifth International Conference on Business Intelligence & Financial Engineering.

Jiao, Z. L. (2016). Service Mode and Development Trend of the “Last-Mile Delivery” of E-commerce Logistics. Contemporary Logistics in China.

Jing, F.,Huiguang, Zh., & Zhaoyang, Ma. (2013). Analysis of Ali's Microfinance Model. Time finance (15).

Jingrong, & Zhang. (2017). Analysis on the Synergy Degree of Zhengzhou-Europe International Block Train and Zhenghzou Cross-border E-commerce Composite System.

Jingyu, Li. (2015). Zheng Ming Logistics under capital assistance. China Storage and Transportation (4), 53-54.

Jing, Z., Yang, Z., Wen, G., & Min, L. (2017). Development characteristics and mechanism of taobao vil ages in jiangsu province under e-commerce economy. China City Planning Review(4), 42-48.

Jose, D. , Prasad, S. , & Sridhar, V. G. . (2015). Intelligent vehicle monitoring using global positioning system and cloud computing. Procedia Computer Science, 50, 440-446.

Ju-Ping, Y., Chang-Chun, Y., & Xuan-Xia, Y. (2014). Research on the “last-mile”issue in the e-commerce logistics system. Journal of Business Economics(4), 16-22.

Jugdev, K., & Mathur, G. (2013). Bridging situated learning theory to the resource-based view of project management. International Journal of Managing Projects in Business, 6(4), 633-653.

Jun, X., & Xiaoxing, L. (2015). Study on the cooperative e-commerce model between enterprises based on the value chain. International technology management (8), 151-153.

Junghyun, K. , & Robert, L. R. . (2017). Interactive e-commerce: promoting consumer efficiency or impulsivity?. Journal of Computer Mediated Communication(1), 1.

Kailing, P. A. N., Liehu, B. A. I., & CHENG, Q. (2007). System Reflection on Double Effect of Management Synergy [J]. Journal of Systemic Dialectics, 1.

Kang, L., & Dong, H. (2014). B2C websites’ usability for Chinese senior citizens. International Conference on Human-computer Interaction.

Katon, W., Von, K. M., Lin, E., Simon, G., Walker, E., & Bush, T., et al. (1995). Collaborative management to achieve depression treatment guidelines. Jama the Journal of the American Medical Association,273(13), 1026-31.

Kawa, A. , & Zdrenka, W. . (2016). Conception of integrator in cross-border e-commerce.

Khokhar, R. H., Bell, D. A., Guan, J., & Wu, Q. X. (2013). Risk assessment of e-commerce projects using evidential reasoning.

Kiani, M. M., Raza, A., & Gill, K. D. (2015). Centralized collaborative reputation model for B2C E-Commerce. Multi-topic Conference.

Kim, D., & Benbasat, I. (2009). Trust-assuring arguments in b2c e-commerce: impact of content, source, and price on trust. Journal of Management Information Systems, 26(3), 175-206.

Kizha, A. R., & Han, H. S. (2016). Processing and sorting forest residues: cost, productivity and managerial impacts. Biomass & Bioenergy, 93, 97-106.

Klaus, P., Erber, G., & Voigt, U. (2001). E-commerce induced change in logistics and transport systems. Economic Bulletin, 38(10), 313-320.

Klusch, M., & Gerber, A. (2001). AN AGENT-BASED MOBILE E-COMMERCE SERVICE PLATFORM FOR FORESTRY AND AGRICULTURE. Intelligent Agent Technology-asia Pacific Conference on Iat.

Kokkinaki, A. I., Dekker, R., Nunen, J. V., & Pappis, C. (1999). An exploratory study on electronic commerce for reverse logistics. Supply Chain Forum An International Journal, 1(1), 10-17.

Kong, L. (2012). A Summary of Research on Supply Chain Collaborative Management in E-commerce Environment. Luojia Management Review (1), 187-193.

Kong, W., & Zheng, Sh. (2012). Talking about the application of modern project management theory in engineering management. Science and technology innovation report (3), 205-205.

Kong, X. (2015). Give cooperatives the wings of e-commerce. Chinese Farmers Cooperative (7), 33-33.

Korhonen, T., Laine, T., & Martinsuo, M. (2014). Management control of project portfolio uncertainty: a managerial role perspective. Project Management Journal, 45(1), 21-37.

Krejci, C. C., Stone, R. T., Dorneich, M. C., & Gilbert, S. B. (2015). Analysis of food hub commerce and participation using agent-based modeling: integrating financial and social drivers. Human Factors, 58(1).

Kuang, G. F. (2012). The development of e-commerce recommendation system based on collaborative filtering. Advanced Engineering Forum, 6-7, 636-640.

Kuang, H. (2014). Research on Dynamic Vehicle Scheduling Optimization of Urban Common Distribution under the Environment of Online Shopping. (Doctoral dissertation, Chongqing University).

Kucharska, W., & Kowalczyk, R. (2016). Trust, Collaborative Culture and Tacit Knowledge Sharing in Project Management – A Relationship Model. International Conference on Intellectual Capital.

Kwong, C. K., Ip, W. H., & Chan, J. W. K. (2002). Combining scoring method and fuzzy expert systems approach to supplier assessment: a case study. Integrated Manufacturing Systems, 13(7), 512-519.

Lacka, E., Chan, Hing Kai, & Yip, Nick. (2014). E-commerce platform acceptance ||. Springer Ebooks.

Lam, H. Y., Choy, K. L., Ho, G. T. S., Cheng, S. W. Y., & Lee, C. K. M. (2015). A knowledge-based logistics operations planning system for mitigating risk in warehouse order fulfillment. International Journal of Production Economics, 170, 763-779.

Ladan, M. I. . (2014). E-Commerce Security Issues. 2014 International Conference on Future Internet of Things and Cloud. IEEE.

Lam, W. (2001). Testing e-commerce systems: a practical guide. It Professional, 3(2), 19-27.

Lamba, D., Yadav, D. K., Barve, A., & Panda, G. (2019). Prioritizing barriers in reverse logistics of e-commerce supply chain using fuzzy-analytic hierarchy process. Electronic Commerce Research, 1-23.

Lee, C. K. M., William Ho, G.T.S. Ho, & H.C.W. Lau. (2011). Design and development of logistics workflow systems for demand management with rfid. Expert Systems with Applications, 38(5), 5428-5437.

Lee, C. K. M., & Chan, T. M. (2009). Development of rfid-based reverse logistics system. Expert Systems with Applications, 36(5), 9299-9307.

Lee, H., & Whang, S. (2002). The Impact of the Secondary Market on the Supply Chain.

Lee, H. L. (2001). Winning the last mile of e-commerce. Mit Sloan Management Review, 42(4), págs. 54-62.

Lee, I. (2012). B2b e-commerce, online auction, supply chain management, and e-collaboration.

Lee, S. J. , Ahn, C. , Song, K. M. , & Ahn, H. . (2018). Trust and distrust in e-commerce. Sustainability, 10(4).

Lee, Y. H., Hu, J. H., Cheng, T. H., & Hsieh, Y. F. (2012). A cost-sensitive technique for positive-example learning supporting content-based product recommendations in b-to-c e-commerce. Decision Support Systems, 53(1), 245-256.

Lefebvre, L. A., Élisabeth Lefebvre, Elia, E., & Boeck, H. (2005). Exploring b-to-b e-commerce adoption trajectories in manufacturing smes. Technovation, 25(12), 1443-1456.

Lei, W. , Jingyun, G. , Long, Q. , Xumin, R. , & Fan, H. U. . (2018). Study on legal supervision of cross-border e-commerce under the initiative of "one belt and one road". Environment and Sustainable Development.

Lerche, L. , Jannach, D. , & Ludewig, M. . (2016). On the Value of Reminders within E-Commerce Recommendations. the 2016 Conference. ACM.

Leung, L. C., Cheung, W., & Hai, Y. V. (2000). A framework for a logistics e-commerce community network: the hong kong air cargo industry. Systems Man & Cybernetics Part A Systems & Humans IEEE Transactions on, 30(4), 446-455.

Lewis, J. P. (2016). Fundamentals of Project Management:.

Li, B. (2012). Research on project management theory and research on frontier problems. Economic research guide (31), 212-214.

Li, B., Yong, Z., Zhang, A., & Cao, Q. (2015). Design of Intelligent Monitoring System for Drop and Pull Transport Freight Depot Based on RFID.

Li, F., & Hou, Y. (2014). Horizontal synergy of shaft-spreading food logistics networks: an integrated conceptual framework. Agricultural economic problems, 35(3), 75-83.

Li, G., & Dong, W. (2013). Optimization for the locations of b2c e-commerce distribution network based on an improved genetic algorithm. Lecture Notes in Electrical Engineering, 236, 223-232.

Li, G., Chen, W., Yang, L., Liu, Q, & Chen, X. (2019). Study on spatial pattern and agglomeration mode of Wuhan express delivery Point. Progress in geography, 38(03), 105-114.

Li, J. (2012). Research on Solution Method of Complex 3D Container Problem Based on Network Mode. (Doctoral dissertation, Lanzhou University of Technology).

LI, J. (2013). Research of regional logistics collaborative growth. (Doctoral dissertation, Jiangxi Finance and Economics University).

Li, J (2016). Development status and future trends of e-commerce in China the status quo and the future of china's e-commerce. Hebei Academic Journal, 036(001), 107-109.

Li, J., Shu, H., & University, J. N. (2014). The empirical research on regional logistics synergy growth. China Business & Market.

Li, J., & Zhu, X. (2013). On Optimization of Logistics Operation Models for Warehouse & Port Enterprises. LISS 2012.

Li, L. (2004). Research on collaborative management of e-commerce projects. (Doctoral dissertation, Tianjin University).

Li, L., Hua, Y., Yu, Q., & Yong, X. (2013). Learning the customer sentiments about E-commerce delivery service. International Conference on Service Systems & Service Management.

Li, M., & Sun, Q. (2017). B2C e-commerce logistics service quality extension evaluation. Business economics research(3), 117-119.

Li, S., & Karahanna, E. (2012). Peer-Based Recommendations in Online B2C E-Commerce: Comparing Collaborative Personalization and Social Network-Based Personalization. Hawaii International Conference on System Science.

Li, W., & Dai, Y. (2015). Research on value evaluation of e-commerce business model ☆. Procedia Computer Science, 60(5-6), 1328-1336.

Li, W., Yu, Y., & Li, Zh. (2015). Study on the passenger car logistics transportation loading problem of company H. 2015 International Conference on Logistics, Informatics and Service Sciences (LISS). IEEE.

Li, X. (2011). Analysis of the Status Quo of e-commerce implementation in China. Corporate Herald, (13), 207-208.

Li, X, & Hai, Y. (2011). Economic evaluation of e-commerce for enterprises. Chinese business theory (9), 101-102.

Li, Yong, Wang, Jianguo, Xie, Haiyan, Liu, Linyue, Zhang, Jianfu, & Xuan, Chun. (2016). Simulation method of charge collection mechanism in cvd diamond detector. 2016 Progress In Electromagnetics Research Symposium, PIERS 2016 - Proceedings.

Li, Y. L., Gao, X. Y., Li, P. G., & Gao, L. (2001). CPFR——A New Trend of Collaborative Supply-chain Inventory Management [J]. Machine Design and Manufacturing Engineering,

Li, Z. (2014). Study on end-point collaborative logistics distribution based on b2c e-commerce mode. Logistics Technology.

Li, Zh. (2014). End-stream collaborative distribution based on b2c e-commerce model. Logistics technology (15), 59-61.

Liang, X. B., Huang, L. X., & Jiang, J. (2017). Research on antecedent factors of solvers' continuous participation in crowdsourcing logistics. Journal of Business Economics.

Liang, Z., Yang, K., Sun, Y., Yuan, J., Zhang, H., & Zhang, Z. (2006). Decision support for choice optimal power generation projects: fuzzy comprehensive evaluation model based on the electricity market. Energy Policy, 34(17), 3359-3364.

Liao, W., & Shan, R. (2014). Research on collaborative problems in multi-project management of e-commerce. E-commerce (2), 58-59.

Lim, Stanley, Jin, Xin, & Srai, Jagjit. (2018). Consumer-driven e-commerce: a literature review, design framework and research agenda on last-mile logistics models. Social Science Electronic Publishing,Accepted(1).

Lin, C. Choy, K. L. , Lam, H. Y. , & Wong, D. W. C. (2012). A web-based intelligent collaborative logistics management decision support system for enhancing the cost effectiveness of door-to-door delivery. Technology Management for Emerging Technologies. IEEE.

Lin, S. M. (2013). Analysis of service satisfaction in web auction logistics service using a combination of fruit fly optimization algorithm and general regression neural network. Neural Computing & Applications, 22(3-4), 783-791.

Lintao, Y. . (2016). China-asean e-commerce collaboration expands. Beijing Weekly: English version, 59(39), 42-43.

Lin Wang, & Shiou-Jie Lin. (2017). A network simplex algorithm for solving the minimum distribution cost problem. Journal of Industrial & Management Optimization, 5(4), 929-950.

Lin, X. (2011). Analysis on key customer satisfaction factors in tpl enterprises. Shanxi Science & Technology.

Lin, X. (2011). Factors affecting e-commerce third-party logistics service satisfaction. Shanxi Science and Technology (4), 27-28.

Lin, Z. . (2014). An empirical investigation of user and system recommendations in e-commerce. Decision Support Systems, 68(dec.), 111-124.

Lin, Z. (2015). Standardization of logistics equipment in the pallet circulation sharing system. Logistics Technology and Application, 20(5), 107-109.

Ling, Z., Thatcher, S. M. B., & Thatcher, M. E. (2014). Institutional environment for business-to-business (b2b) e-commerce usage: toward an understanding in the chinese context. Journal of Information Technology Case & Application Research, 16(3-4), 127-154.

Liu, B., Hua, H., & Li, J. (2015). The Research of Commodity E-commerce and Logistics Collaborative System Based on the Electronic Warehouse Receipts. LISS 2013.

Liu, B., & Yuan, X. (2016). Research on influencing factors of customer satisfaction of logistics service under O2O e-commerce mode. Enterprise technology development, 35(23), 123-125.

Liu, C. Y., & Jin-Peng, L. U. (2005). On logistics mode of enterprises with b2c e-commerce. Logistics Technology.

Liu, Ch., & Lu, J. (2005). Research on logistics mode of B2c e-commerce enterprises. Logistics technology (1), 76-79.

Liu, D. (2014). Network site optimization of reverse logistics for e-commerce based on genetic algorithm. Neural Computing & Applications,25(1), 67-71.

Liu, D., & Lu W. (2014). The coordinated development path of China's e-commerce industry and express delivery industry. Technical economy, 33(2), 45-49.

Liu, G. (2018). Research Strategy of Logistics Distribution of b2c E-commerce Enterprises in Low Carbon Economy. Information and Communication,No.186(6), 293-294.

Liu, G. , Nguyen, T. T. , Zhao, G. , Zha, W. , & Chen, W. . (2016). Repeat Buyer Prediction for E-Commerce. the 22nd ACM SIGKDD International Conference. ACM.

Liu, H. (2006). Research on Knowledge Management Based on Project Enterprises. Economist (01), 172-173.

Liu, H. (2017). Research on the innovation of cainio network business model. Business research, 59(1), 19-26.

Liu, Haidong. (2004). Use of e-commerce information. Chinas Foreign Trade(5), 48-49.

LIU Haiyan, PANG Xiaoping, WANG Yue, & LI Zhongxiang. (2017). Quantitative research for site-selection of antarctic year-round research stations based on logistic regression. , 42(3), 390-394.

Liu, J. G. (2011). Strategy on combined transport of vehicle logistics for multi-franchisers competition. Chinese Journal of Management Science.

Liu, J. S., Lu, L. Y. Y., Lu, W. M., & Lin, B. J. Y. (2013). Data envelopment analysis 1978–2010: a citation-based literature survey. Omega-international Journal of Management Science, 41(1), 3-15.

Liu, M., & Zhao, L. D. (2011). Mixed-collaborative distribution mode of emergency materials. Control & Decision, 26(1), 96-100.

Liu, P. (2012). 020 Local life service e-commerce model research. (Doctoral dissertation, Beijing University of Posts and Telecommunications).

Liu, Sh. (2005). Research on supply chain collaborative management in e-commerce environment. Scientific and technological progress and countermeasures, 22(10), 166-167.

Liu, W. (2014). Construction of e-commerce information services platform in international trade. Advanced Materials Research, 926-930, 2512-2515.

Liu, X. (2010). Discussion on the design science of management research. Science and science technology management, 31(5), 71-75.

Liu X. (2015). Design and analysis of project management information system based on e-commerce. Technology outlook (18).

Liu, X., & Zhao, Y. (2017). Container LCL operation mode integration and intelligent innovation. Soft Science, 31(12), 16-19.

Liu, Z. (2010). Dissipative structure theory, synergetics, and their implications for the management of information systems. Journal of the American Society for Information Science, 47(2), 129–135.

Long, Zhenjie, & Pan, Fan. (2016). Enterprise business model innovation in e-commerce environment. 3d International Conference on Applied Social Science Research.

López-Nores, M., Blanco-Fernández, Y., & Pazos-Arias, J. J. (2013). Cloud-based personalization of new advertising and e-commerce models for video consumption. Computer Journal, 56(5), 573-592.

Lu, G., Gao, G., Hu, L., Hao, R., & Liu, D. (2009). Designed of Remotely Monitoring System of Great Warehouse Based on CAN Bus. International Conference on Multimedia & Information Technology.

Lu, H., An, Ch., Cheng, Zh, & Tang, W. (2012). Research and application of vehicle matching system based on saas and cscw. Journal of Huazhong University of Science and Technology (Natural science edition)(s1), 324-327.

Lu, J., Chen, W., & Cao, S. (2016). Research on cooperative mode of e-commerce logistics of fresh agricultural products. Price Monthly (2), 72-75.

Lu, L. (2010). Study on the profit distribution of virtual logistics alliance. International Conference on Educational & Information Technology.

Lu, Q., & Nan, L. (2015). Effects of e-commerce channel entry in a two-echelon supply chain: a comparative analysis of single- and dual-channel distribution systems. International Journal of Production Economics, 165, 100-111.

Lu, X. (2004). Electronic commerce and certification. Heilongjiang Social Sciences.

Luckett, D. (2004). The supply chain. Bt Technology Journal, 22(3), 50-55.

Luo, J, & Xu, Zh. (2012). Value-added service innovation model of logistics enterprises-e-commerce operation. Journal of Huaihua University, 30(5), 52-55.

Luo, J. J., & Zhong-Sheng, X. U. (2012). The new value-added service model of the logistics enterprise:the agency-operation services about e-commerce. Journal of Huaihua University, 8(7), e66948-e66948.

Luo, M, & Chen, Y. (2016). Countermeasure Research on the "last mile" of e-commerce logistics by intelligent self-reporting cabinet. Logistics technology, 35(5), 22-24.

Luo, R., Wang, Zhi Ling, & Wang, Lei. (2010). Design of logistics information system architecture based on gis. Computer Engineering & Design, 687-691(6), 2599-2602.

Luo, R. C., Lan, C. C., Tzou, J. H., & Chen, C. C. (2004). The development of WEB based e-commerce platform for rapid prototyping system. IEEE International Conference on Networking.

Ma, H. (2012). Analysis of the application status of O2O e-commerce model in China. Technological horizon (26), 244-245.

Ma, X. (2017). Research on Simulation Module Library of Container Terminal Logistics System Based on Jackson Queuing Network. (Doctoral dissertation, Wuhan University of Technology).

Ma, Y., Yao, T., & Zhang, H. (2013). Multi-distribution Center Multi-vehicle Vehicle Scheduling Problem and Genetic Algorithm Design Based on Partition. Science and technology guide (2), 61-67.

Mackey, T. K., Miner, A., & Cuomo, R. E. (2015). Exploring the e-cigarette e-commerce marketplace: identifying internet e-cigarette marketing characteristics and regulatory gaps ☆. Drug & Alcohol Dependence, 156, 97-103.

Madlberger, M. (2006). Multi-channel retailing in b2c e-commerce. Encyclopedia of E-Commerce, E-Government, and Mobile Commerce.

Mahdi Choshin, & Ali Ghaffari. (2017). An investigation of the impact of effective factors on the success of e-commerce in small- and medium-sized companies. Computers in Human Behavior, 66, 67-74.

Marakas, G. M. (2003). Modern Data Warehousing, Mining, and Visualization: Core Concepts.

Masimbe, A., & Bigirimana, S. (2014). An investigation into features of e-commerce and their challenge on classic regulation in zimbabwe. Christian Science Monitor.

Masudin, I., & Saputro, T. E. (2016). Evaluation of b2c website based on the usability factors by using fuzzy ahp & hierarchical fuzzy topsis. IOP Conference

Series: Materials Science and Engineering, 114(1), 012091.

Mayuri, & Odedra-Straub. (2017). "e-commerce and development": whose development?. Electronic Journal of Information Systems in Developing Countries.

Meadows, D. (2015). Envisioning a sustainable world.

Mei, T., Rui, Y., Li, S., & Tian, Q. (2014). Multimedia search reranking:a literature survey. Acm Computing Surveys, 46(3), 1-38.

Mengke, Yang, Movahedipour, Mahmood, Xiaoguang, & Zhou, et al. (2017). Design and implementation of cloud platform for intelligent logistics in the trend of intellectualization. China Communications, 14(10), 180-191.

Mcafee A, Brynjolfsson E. Big Data:The Management Revolution[J].Harvard Business Review,2012(10):16-17

Miao, Y., Yue, G., Lu, Z., & Xu, P. (2018). Logistics terminal distribution mode and path optimization based on ant colony algorithm. Wireless Personal Communications(8), 1-17.

Michelberger, B., Andris, R. J., Girit, H., & Mutschler, B. (2013). A Literature Survey on Information Logistics. International Conference on Business Information Systems.

Michelberger, B., Mutschler, B., & Reichert, M. (2012). A Context Framework for Process-Oriented Information Logistics.. Business Information Systems.

Ming, Y. (2017). Express Logistics Distribution Model Optimization for E-Commerce Environment. International Conference on Smart Grid & Electrical Automation.

Miao, D. (2001). Current situation and prospect of complexity research. Journal of Systemic Dialectics.Haken, . C. M. H. (2017). Information and self-organization. Springer,18(6), 197.

Miao, W., & Zhan, B. C. (2011). The Design of Rural Consumer Services Cooperatives Management System Based on E-Commerce. Information & Automation-international Symposium.

Mishra, A., Gunasekar, S., & Gupta, D. (2017). Influence of product perception and discounts on the preference of online payment. IEEE International Conference on Computational Intelligence & Computing Research.

Mistro, R. D., & Behrens, R. (2015). Integrating the informal with the formal: an estimation of the impacts of a shift from paratransit line-haul to feeder service provision in cape town. Case Studies on Transport Policy,3(2), 271-277.

Mitchell, J. (1999). Framing the Future: An E-Commerce Operation.

Mladenow, A., Bauer, C., & Strauss, C. (2015). Crowdsourcing in logistics:concepts and applications using the social crowd.

Mo, J. (2013). Systems of systems engineering: principles and applications. Crc Press.

Mohamed, U. A., Galaledeen, G. H., & Elzoghbi, A. A. (2010). Building an integrated b2b e-commerce hub architecture based on soa and semantic ontology. Journal of Enterprise Information Management, 23(6), 775-812.

Mohammadjafari, M., Ahmed, S., Dawal, S. Z. M., & Zayandehroodi, H. (2011). Reducing time and cost of new product development in smes by e-collaboration through project management approach. Advanced Science Letters, 4(6-7), 2513-2516.

Mokhtarian, P. L. (2004). A conceptual analysis of the transportation impacts of b2c e-commerce. Transportation, 31(3), 257-284.

Morita, T. (2014). Reflections on the works of jacques bertin: from sign theory to cartographic discourse. Cartographic Journal, 48(2), 86-91.

Motadel, M. R., Radfar, R., & Babaie, M. (2012). Feasibility of electronic commerce at cooperative in gilan province to select an appropriate e-commerce model by using fuzzy analysis network process. International Journal of Information.

Montenegro, C., Fonseca, R., & Larco, A. (2017). IT process improvement: Developing an agile model using the DSR approach. International Conference on Software Process Improvement.

Montoya-Torres, J. R., Muã±Oz-Villamizar, A., & Vega-MejãA, C. A. (2016). On the impact of collaborative strategies for goods delivery in city logistics. Production Planning & Control, 27(6), 443-455.

Morgeson, F. P., Mitchell, T. R., & Liu, D. (2015). Event system theory: an event-oriented approach to the organizational sciences. Academy of Management Review, 40(4), págs. 515-537.

Mu, R. (2013). The Research of Supply Chain Management Information Systems Based on Collaborative E-Commerce. Proceedings of the 2012 International Conference of Modern Computer Science and Applications.

Naudet, Y., Guedria, W., & Chen, D. (2009). Systems Science for Enterprise Interoperability. International Conference on Interoperability for Enterprise Software & Applications China.

Ngai, E. W. T., & Wat, F. K. T. (2002). A literature review and classification of electronic commerce research. Information & Management, 39(5), 415-429.

Nie, G., She, Q., & Chen, D. (2011). Evaluation index system of cloud service and the purchase decision- making process based on ahp.

Ni, H., Sun, T., & Chen, P. Y. (2017). Social media integration and e-commerce platform performance: a randomized field experiment. Social Science Electronic Publishing.

Ni, X., Gu, J., & Yang, Y. (2017). Integration of rural e-commerce and "internet plus" emerging logistics format analysis. Logistics Technology, 040(003), 56-59.

Nie, L., Fu, C. X., & Huang, L. H. (2012). A decision-making model of enterprise transformation to platform-based b2b e-commerce business model: enterprise's competence view. Shanghai Journal of Economics.

Niederman, F. (2005). Staffing and management of e-commerce programs and projects. Acm Sigmis Cpr Conference on Computer Personnel Research.

Nielsen, C. B., Larsen, P. G., Fitzgerald, J., Woodcock, J., & Peleska, J. (2015). Systems of systems engineering:basic concepts, model-based techniques, and research directions. Acm Computing Surveys, 48(2), 1-41.

Ning, Sh., Niu, W., Chen, X., & Li, P. (2017). Van truck loading rate management system based on internet of things cloud computing. CN107194642A.

Nof, S. Y. (2007). Collaborative control theory for e-work, e-production, and e-service. Annual Reviews in Control, 31(2), 281-292.

O Conchuir, D. (2011). Overview of the Pmbok Guide: Short Cuts. Overview of the PMBOK Guide: Short Cuts for PMP Certification.

Olorunniwo, F. O., & Li, X. (2010). Information sharing and collaboration practices in reverse logistics. Supply Chain Management, 15(6), 454-462.

Oppenheim, B. W. , Murman, E. M. , & Secor, D. A. . (2011). Lean enablers for systems engineering. Systems Engineering,14(1), 29-55.

Oreku, G. S. (2013). Mobile technology interaction to e-commerce in promising of u-commerce. African Journal of Business Management(2), 85-95.

Oum, T. H., & Park, J. H. (2004). Multinational firms' location preference for regional distribution centers: focus on the northeast asian region. Transportation Research Part E Logistics & Transportation Review, 40(2), 101-121.

Palese, B. , & Usai, A. . (2018). The relative importance of service quality dimensions in e-commerce experiences. International Journal of Information Management, 40(JUN.), 132-140.

Palmer, R. K. (2006). Apparatus and methods for processing and distribution of perishable food products.

Pan, B., Tao, Z., & Yu, W. (2010). The Integration Strategy of E-commerce Platform and ERP Based on Cooperative Application. International Conference on E-business & E-government.

Pan, Sh. (2010). Design and Construction of Campus E-commerce Information Platform. Inner Mongolia weather, 2010(3), 42-44.

Pan, X., & Ju, X. F. (2009). A Research on Development of Chinese B2C E-Commerce Trust. International Conference on E-business & Information System Security.

Pan, Zh. (2016). Research on the construction of e-commerce and logistics collaborative management Model in the age of big data. Logistics Engineering and Management, 38(7), 18-19.

Paloheimo H, Lettenmeier M, Waris H. Transport reduction by crowdsourced deliveries 一 alibrary case in Finland[J]. Journal of Cleaner Production, 2015, 132:240-251.

Panda, S., Modak, N. M., Sana, S. S., & Basu, M. (2015). Pricing and replenishment policies in dual-channel supply chain under continuous unit cost decrease. Applied Mathematics & Computation, 256(C), 913-929.

Paris, D. L., Bahari, M., & Iahad, N. A. (2015). Exploring implementation factors influencing business-to-customer (b2c) e-commerce. Advanced Science Letters, 21(5), 1455-1459.

Peled, M., & Dvir, D. (2013). Customer involvement in projects: Adapting the involvement mode to project characteristics. Technology Management in the It-driven Services.

Peng, G., & Ma, B. (2018). Exploration of express logistics packaging. Shanghai Packaging, 284(10),30-33.

Peng, Z. L., & Huang, You Lan. (2014). Research on e-commerce intelligence based on iot and big data. Applied Mechanics & Materials,496-500, 1889-1894.

Peterson, Robert, A., Kim, & Yeolib. (2017). A meta-analysis of online trust relationships in e-commerce. Journal of Interactive Marketing.

Phythian, C. J., Cripps, P. J., Michalopoulou, E., Jones, P. H., Dai, G. W., & Clarkson, M. J., et al. (2012). Reliability of indicators of sheep welfare assessed by a group observation method. Veterinary Journal, 193(1), 257-263.

Ping, L. (2010). Human Resource Management Strategy in E-Commerce Enterprises. International Conference on E-business & E-government.

Ping, Y., & Qin, H. (2011). The assessment research of operational risk in the road freight industry undertake cold chain logistics services. International Conference on Remote Sensing.

Plewa, M., Giel, R., & Młyńczak, M. (2015). Logistic Support Model for the Sorting Process of Selectively Collected Municipal Waste. Theory and Engineering of Complex Systems and Dependability.

Polasik, M., & Fiszeder, P. (2010). Factors determining the acceptance of payment methods by online shops in poland. Social Science Electronic Publishing(1541202).

Pope, A. (2010). Terminal distribution. Architectural Design, 78(1), 16-21.

Prasanna, K. R., & Hemalatha, M. (2012). Rfid gps and gsm based logistics vehicle load balancing and tracking mechanism. Procedia Engineering, 30(4), 726-729.

Project Management Institute, (2017). Project Management Body Of Knowledge,6th Edition.

Qi, H. X. (2013). The Study of Drop and Pull Transport Mode Based on Low-Carbon Transport Organization. International Asia Conference on Industrial Engineering and Management Innovation (IEMI2012) Proceedings.

Qi, L. , Xu, X. , Zhang, X. , Dou, W. , Hu, C. , & Zhou, Y. , et al. (2018). Structural balance theory-based e-commerce recommendation over big rating data. Big Data, IEEE Transactions on, 4(3), 301-312.

Qian, D., & Yang, J. (2013). Input-output analysis on the contribution of logistics park construction to regional economic development ☆. Procedia - Social and Behavioral Sciences, 96, 599-608.

Qian, S (1981). Talking about the system of system science. System Engineering Theory and Practice, 1(1), 0-0.

Qiang, D. J., Shou, T., Zhu, T. M., Huang, M. X., Zhong, Y. F., & Fan, H. (2013). An evaluation index system and comprehensive evaluation model on high-voltage distribution network planning. Power System Protection & Control, 41(21), 52-57.

Qiu, Z. (2014). Research and application on intelligent self-service cabinet for parcels——taking amazon as an example. Science Mosaic.

Qu, X. H., Song, W. F., Ding, B. R., & Han, Z. (2011). Research on the triangle distribution model based on third-party logistics alliance. IEEE International Conference on Industrial Engineering & Engineering Management.

Rabinovich, E., & Bailey, J. P. (2004). Physical distribution service quality in internet retailing: service pricing, transaction attributes, and firm attributes. Journal of Operations Management, 21(6), 651-672.

Rahayu, R. , & Day, J. . (2017). E-commerce adoption by smes in developing countries: evidence from indonesia. Eurasian Business Review, 7.

Rahi, S. , & Ghani, M. A. . (2016). Customer's perception of public relation in e-commerce and its impact on e-loyalty with brand image and switching cost. Journal of Internet Banking and Commerce, 21(213).

Rajaram, S., & Pereirapasarin, L. P. (2010). Collaborative memory: cognitive research and theory. Perspectives on Psychological Science A Journal of the Association for Psychological Science, 5(6), 649.

Rajib kumar Dutta. (2014). Strategic cost management in logistics and transportation - an overview.

Ramiro Gonçalves, Tânia Rocha, José Martins, Frederico Branco, & Manuel Au-Yong-Oliveira. (2017). Evaluation of e-commerce websites accessibility and usability: an e-commerce platform analysis with the inclusion of blind users. Universal Access in the Information Society(18), 1-17.

Ramos, Ana Luísa, Ferreira, José Vasconcelos, & Barceló, Jaume. (2011).Model-based systems engineering: an emerging approach for modern systems. IEEE Transactions on Systems Man & Cybernetics Part C, 42(1), 101-111.

Rao, W. (2017). Scientific design of the project, modernization of research methods, practical use of scientific research results. Modern gardening (11), 149-150.

Rattanamanee, T., Nanthavanij, S., & Ammarapala, V. (2017). Vehicle dispatching for minimizing arrival conflicts in multi-supplier logistics network. Arabian Journal for Science & Engineering(3), 1-12.

Ravikanth Chaganti. (2018). DSC and Google Cloud Platform. Pro PowerShell Desired State Configuration.

Rayed, AlGhamdi, Steve, Drew, Waleed, & Al-Ghaith. (2017). Factors influencing e-commerce adoption by retailers in saudi arabia: a qualitative analysis. The Electronic Journal of Information Systems in Developing Countries.

Regan, E. A., & Wymer, S. (2011). Influential factors in the adoption and use of e-business and e-commerce information technology eeit by small & medium businesses. Journal of Electronic Commerce in Organizations,9(1), 56-82.

Ren, X., Zhu, X., He, Zh., Xiang, X., Chen, D., & RENXuetian. (2015). Third-party cold chain logistics enterprise vehicle scheduling based on improved c-k saving algorithm. Journal of Beijing Jiaotong University, 39(4), 125-132.

Ren, Zh. (2017). Investigation report on the construction of Weihai City e-commerce express distribution center logistics park. Manager (29), 73.

Richardson, G. L. (2010). Project management theory and practice, second edition. Project Management Journal, 41(5), 87-87.

Rita, Paulo, Oliveira, Tiago, Dhillon, & Gurpreet. (2017). Modelling and testing consumer trust dimensions in e-commerce. Computers in Human Behavior.

Robbie T． Nakatsu， Deigning business logistics networks using model based reasoning and heuristic—based searching[J]． Expert Systems with Applications． 2013，(29)：735～745

Romanovsky, A., & Thomas, M. (2013). Industrial Deployment of System Engineering Methods.

Rong-Xue, D. U. , & Guo-Xiang, R. . (2015). The feasibility analysis of intelligent container in the communities of city. Logistics Sci-Tech.

Ross, H. L. (2016). System Engineering. Functional Safety for Road Vehicles.

Rusnjak, A., Kharbili, M. E., Hristov, H., & Speck, A. (2010). Managing the Dynamics of E/mCommerce with a Hierarchical Overlapping Business-Value-Framework. IEEE International Conference on Advanced Information Networking & Applications Workshops.

Sahi, G., & Madan, S. (2013). Assessing the differential effect of web usability dimensions on perceived usefulness of a b2c e-commerce website. Communications in Computer & Information Science, 409, 198-211.

Santibanez-Gonzalez, E. D. R., & Diabat, A. (2016). Modeling logistics service providers in a non-cooperative supply chain. Applied Mathematical Modelling, 40(13-14), 6340-6358.

Schniederjans, Marc, J., Garvin, & Tim. (1997). Using the analytic hierarchy process and multi-objective programming for the selection of cost drivers in activity-based costing. European Journal of Operational Research, 100(1), 72-80.

Setyawan, S. (2015). E-commerce dalam manajemen pemasaran. Jurnal Manajemen.

Sha, K. (2010). Theoretical framework for construction projects: positions, perspectives and methodologies. Construction economy (10), 95-97.

Shankar, D. , Narumanchi, S. , Ananya, H. A. , Kompalli, P. , & Chaudhury, K. . (2017). Deep learning based large scale visual recommendation and search for e-commerce.

Sheard, S. A., & Mostashari, A. (2010). Principles of complex systems for systems engineering. Systems Engineering, 12(4), 295-311.

Shen, Y. (2018). Preliminary Study on the Construction of Road Freight Vehicle Operation Analysis System. Traffic and port,v.5(2), 62-65.

Sheng, G. (2007). A collaborative network e-commerce deconstruction model. Nankai Management Review,10(6), 105-109.

Sheng, G., & Cai, H. (2013). A research on the commercial value chain of mobile electron——a case from china mobile application store.Journal of Zhaoqing University.

Sheng, L., & Xia, T. (2013). Application of rfid technology in fresh milk processing and packaging logistics management. Applied Mechanics & Materials, 469(3), 477-480.

Shi, X., Tao, Dongkai, & Vo?, Stefan. (2011). Rfid technology and its application to port-based container logistics. Journal of Organizational Computing & Electronic Commerce, 21(4), 332-347.

Shiang, C. W., Halin, Alfian Abdul, Lu, Marlene, & CheeWhye, Gary. (2016). Long lamai community ict4d e-commerce system modelling: an agent oriented role-based approach. Electronic Journal of Information Systems in Developing Countries, 75(1), 1-22.

Shishodia, A., Dixit, V., & Verma, P. (2018). Project risk analysis based on project characteristics. Benchmarking An International Journal, 25(1), 00-00.

Shuai, D., Li, Y., Zhou, T., & Yi, C. (2015). Study on Recyclable Reserve Logistics Network Optimization Based on E-Commerce. International Conference on Management of E-commerce & E-government.

Shuang, S., Qu, S., & Li, H. (2010). Design of Vehicle Dispatching and Monitoring System in Airdrome. International Conference on Measuring Technology & Mechatronics Automation.

Shull, S., Gralla, E., Silver, M., Xin, L., & Weck, O. D. (2013). Logistics Information Systems for Human Space Exploration. Spaceops Conference.

Simi, Dragan, Simi, & Svetlana. (2012). Hybrid artificial intelligence approaches on vehicle routing problem in logistics distribution. International Conference on Hybrid Artificial Intelligent Systems.

Singh, M. (2002). E - services and their role in b2c e - commerce. Journal of Service Theory & Practice, 12(6), 434-446.

Sinha, R., & Rabinovich, E. (2006). Logistics: the key to e-retail success. Social Science Electronic Publishing.

Slimani, I., & Achchab, S. (2014). Game theory to control logistic costs in a two-echelon supply chain. 2014 International Conference on Logistics and Operations Management (GOL). IEEE.

Sokhanvar, S., Matthews, J. H., & Yarlagadda, P. K. (2014). Management of project knowledge in a project-based organisation : a case study of research enterprise. Knowledge Management.

Song. (2014). Design and development of color purchase network e-commerce system. (Doctoral dissertation, Donghua University).

Song, J. (2018). Analysis of the choice of logistics distribution mode based on b2c e-commerce enterprise. Market Modernization, (5), 30-31.

Song, J. (2018). Where is China's e-commerce going?. China E-commerce (7), 10-15.

Song, M, & Huang, X. (2014). Discussion on the development of rural e-commerce based on cooperatives. Business economics research (26), 75-77.

Sorkin, D. E. (2002). Payment methods for consumer-to-consumer online transactions. Social Science Electronic Publishing.

Srinivasan, S. S., Anderson, R., & Ponnavolu, K. (2002). Customer loyalty in e-commerce: an exploration of its antecedents and consequences. Journal of Retailing, 78(1), 41-50.

Stannard, B., ZAHIR, SAJJAD, & ROSENBLOOM, EARL S. (2006). Application of analytic hierarchy process in multi-objective mixed integer programming for airlift capacity planning. Asia-Pacific Journal of Operational Research, 23(01), 61-76.

Sterman, J. D. 2010. Does formal system dynamics training improve people's understanding of accumulation? System Dynamics Review, 26, 316-334.

Stevens, G. C. (1989). Integrating the supply chain. International Journal of Physical Distribution & Logistics Management, 19(8), 3-8.

Steinberg, A. N. (2001). Data fusion system engineering. IEEE Aerospace & Electronic Systems Magazine, 16(6), 7-14.

Stevens, G. C. (1989). Integrating the supply chain. International Journal of Physical Distribution & Logistics Management, 19(8), 3-8.

Stoll, K. U., & Hepp, M. (2013). Detection of E-Commerce Systems with Sparse Features and Supervised Classification. IEEE International Conference on E-business Engineering.

Suguna, S. , Vithya, M. , & Eunaicy, J. I. C. . (2016). Big data analysis in e-commerce system using HadoopMapReduce. 2016 International Conference on Inventive Computation Technologies (ICICT). IEEE.

Sui, L., & Tan, Q.,. (2015). Strategies and suggestions for customer satisfaction improvement in e-commerce logistics distribution enterprises. Logistics technology (9), 78-80.

Sun, D., Wen, S., Xin, T., & Xue, J. (2009). Construction and Management of Electronic Commerce Knowledge System Innovation Experimental Plot Project. International Symposium on Computer Network & Multimedia Technology.

Sun, J., & Lun, J. (2011). Credibility evaluation of B-to-C e-commerce enterprise. International Conference on Business Management & Electronic Information.

Sun, S. T., & Zhao, Q. L. (2010). Application of traffic simulation technology in modern logistics vehicle dispatching. Logistics Technology.

Sun, X. (2015). E-commerce logistics distribution mode analysis and decision. Applied Mechanics & Materials, 744-746, 1873-1877.

Sun, X., Chu, X., & Wu, Z. (2015). Logistics Hybrid Cloud Services Based on the Theory of Collaborative Management.

Szymczak, C. C., & Walker, D. H. T. (2013). Boeing – a case study example of enterprise project management from a learning organisation perspective. Learning Organization, 10(3), 125-137.

Tadelis, S. . (2016). The economics of reputation and feedback systems in e-commerce marketplaces. Internet Computing, IEEE, 20(1), 12-19.

Takanobu, R. , Zhuang, T. , Huang, M. , Feng, J. , Tang, H. , & Zheng, B. . (2019). Aggregating e-commerce search results from heterogeneous sources via hierarchical reinforcement learning.

Tan, X., Xie, W., & Li, P. (2010) Classification, application and innovation of e-commerce models. Technology and Economy, 29(10), 6-11.

Tan, Y., & Shi, X. A. (2014). Standardized operation system of e-commerce supply chain of agricultural products based on scor. Applied Mechanics & Materials, 701-702, 7.

Tang, G., Xu, R., Tang, J., & He, R. (2010). Engineering change impact analysis based on Design Structure Matrix. Journal of Mechanical Engineering, 46(1), 154-161.

Tang, H., & Men, F. (2002) . Graphic modern logistics, IT logistics. Wenhui Publishing House.

Tang, L. (2016). Analysis on the End-of-sale Distribution of University Logistics under the Trend of E-commerce Rapid Development. Business economics research (6), 91-93.

Tao, J., Pan, L., & Chu, Y. (2016). Research on urban and rural logistics network reconstruction in big data era. China's circulation economy, 30(11), 22-32.

Tao, J. C., Pan, L., & Chu, Y. P. (2016). Research on the reconstruction of urban and rural logistic networks in the era of big data. China Business & Market.

Tao, W. J., Zhan, Bin, & Wang, Meng. (2014). Research on the benefit evaluation of energy saving and emission reduction of drop-and-pull transport. Applied Mechanics & Materials, 505-506(505-506), 554-557.

Tardif, V., Tayur, S., Reardon, J., Stines, R., & Zimmerman, P. (2010). Implementing seasonal logistics tactics for finished goods distribution at deere & company's c&ce division. Operations Research, 58(1), 1-15.

Thompson, R. G., & Hassall, K. P. (2012). A collaborative urban distribution network. Procedia - Social and Behavioral Sciences,39(2312), 230-240.

Tolk, A. (2013). Modeling and Simulation Support for System of Systems Engineering Applications.

Trad, A., & Kalpić, D. (2016). The e-business transformation framework for e-commerce architecture-modeling projects.

Trautman, L. J. (2017). How law operates in a wired global society: cyber and e-commerce risk. Social Science Electronic Publishing.

Tsai, W. T. (2005). Service-Oriented System Engineering: A New Paradigm. Service-oriented System Engineering, Sose IEEE International Workshop.

Türkay, M., Oruç, C., Fujita, K., & Asakura, T. (2004). Multi-company collaborative supply chain management with economical and environmental considerations. Computers & Chemical Engineering, 28(6-7), 985-992.

Turkulainen, V. , & Swink, M. L. . (2016). Supply chain personnel as knowledge resources for innovation - a contingency view. Journal of Supply Chain Management.

Vachon, S., & Klassen, R. D. (2006). Extending green practices across the supply chain: the impact of upstream and downstream integration. International Journal of Operations & Production Management, 26(7), 795-821.

Vaishnavi, V. K. (2015). Design Science Research Methods and Patterns: Innovating Information and Communication Technology.

Van Binsbergen, A. J., & Visser, J. G. S. N. (2001). Innovation Steps towards Efficient Goods Distribution Systems for Urban Areas. (Doctoral dissertation).

Vangen, S. (2003). Collaboration theory for collaboration practice: transfer design principles.

Vanhoucke, M. (2013). Project Management with Dynamic Scheduling. Project management with dynamic scheduling : baseline scheduling, risk analysis and project control /.

Vanovermeire, C., & Sörensen, K. (2014). Measuring and rewarding flexibility in collaborative distribution, including two-partner coalitions ☆. European Journal of Operational Research, 239(1), 157-165.

Verdonck, L., Caris, A. N., Ramaekers, K., & Janssens, G. K. (2013). Collaborative logistics from the perspective of road transportation companies. Transport Reviews, 33(6), 700-719.

Viani, F., Salucci, M., Robol, F., Oliveri, G., & Massa, A. (2012). Design of a uhf rfid/gps fractal antenna for logistics management. Journal of Electromagnetic Waves & Applications, 26(4), 480-492.

Viktor Morozov, Olena Kalnichenko, & Iuliia Liubyma. (2018). Proactive project management for development of distributed information systems.

Wagner, G. (2013). Effects of cross-channel synergies and complementarity in a multichannel e-commerce system – an investigation of the interrelation of e-commerce, m-commerce and ietv-commerce. International Review of Retail Distribution & Consumer Research, 23(5), 571-581.

Wakabayashi, K., Suzuki, K., Watanabe, A., & Karasawa, Y. (2014). Analysis and Suggestion of an e-Commerce Logistics Solution: Effects of Introduction of Cloud Computing Based Warehouse Management System in Japan. Logistics Operations, Supply Chain Management and Sustainability.

Walzer, N., & Colavito, J. (2005). Internet purchases by rural residents: implications for community development. Community Development,36(1), 54-64.

Wamba, S. F. (2012). Achieving supply chain integration using rfid technology: the case of emerging intelligent b - to - b e - commerce processes in a living laboratory. Post-Print, 18(1), 58-81.

Wang, C., & Mu, D. (2014). A simulated annealing for designing the distribution network of a “Collect-on-delivery” company in a metropolis context. International Conference on Service Systems & Service Management.

Wang, C. D. , Deng, Z. H. , Lai, J. H. , & Yu, P. S. . (2019). Serendipitous recommendation in e-commerce using innovator-based collaborative filtering. Cybernetics, IEEE Transactions on, 49(7), 2678-2692.

Wang, D. Research on the Influence of Project Characteristics on Tacit Knowledge Transfer in New Product Development Process [D]. Zhejiang University,2007.

Wang, E. T. G., Wang, E. T. G., Fang, Y. H., & Huang, H. Y. (2013). Understanding customers' repeat purchase intentions in b2c e-commerce: the roles of utilitarian value, hedonic value and perceived risk. Information Systems Journal, 24(1), 85-114.

WANG En-tong,ZHAO Lu-hua,GUAN De-yong,DOU Xin-yu,LI Yang.Vehicle Scheduling Problem with Sharing Strategy.Packaging Engineering, 40(7), 142-147.

Wang, H. W., Yan, Y. S., & Duan, H. W. (2014). Measuring the performance of e-commerce logistics system based on fuzzy-ahp. Applied Mechanics & Materials, 505-506, 4.

Wang, H. Y. (2014). On the fresh food logistics distribution in e-commerce based on the mode of gps& wechat two dimensional code. Journal of Anhui University of Technology.

Wang, J., & Dong, G. (2015). Construction of synergetic system of fresh e-commerce cold chain logistics. Logistics Technology, 34(13), 21-22.

Wang, J., & Qiu, Z. (2013). Research on multi-project collaborative management. Oriental corporate culture (16).

Wang, L. (2017). Development experience of ending logistics distribution in foreign cities and its reference. Logistics Engineering and Management,39(7), 16-19.

Wang, L., Han, X., & Qiang, J. (2014). Semi-supervised affinity propagation clustering algorithm based on fireworks explosion optimization, International Conferenceon Managementofe-Commerceande-Government(ICMeCG2014).

Wang, L. R., & Wu, Z. F. (2015). Implementation on E-Commerce Network Marketing Based on WEB Mining Technology. Seventh International Conference on Measuring Technology & Mechatronics Automation.

Wang, Q., Yi, Y., & Qi, W. Q. M. (2014). The effect of human image in b2c website design: an eye-tracking study. Enterprise Information Systems,8(5), 582-605.

Wang, Q, Zhang, L, & Zhang, J. (2016). Design and implement of agricultural e-commerce system based on mobile internet. computer application, 036(0z1), 286-290.

Wang, S, & Chen, L. (2018). How to give full play to the role of "Cainio Station" in the distribution of logistics terminals. Management and management, 411(09),

89-91.

Wang, X., Li, L., Ling, T., & Ao, J. (2009). Business to Consumer E-commerce Enterprises Analysis: A Case Study of eguo.com. International Conference on Computer Technology & Development.

Wang, X., Ren, A., & Liu, X. (2017). Researching on quantitative project management plan and implementation method.

Wang, Y. (2006). On the optimal allocation of information resources under collaborative e-commerce. China Management Informationization,9(6), 41-43.

Wang, Y. (2006). Reserch of information resource share in collaboration e-business. Science Mosaic.

Wang, Y. (2015). Towards the abstract system theory of system science for cognitive and intelligent systems. Complex & Intelligent Systems, 1(1-4), 1-22.

Wang, Y., & Kou, G. (2017). New business model: e-commerce + cooperative. Chinese Farmers Cooperative (1), 47-48.

Wang, Y., & Lu, Y. (2018). Research on collaborative management strategy of e-commerce supply chain in fresh agricultural products. Economic Research Guide, 379(29), 72-74.

Wang, Y., & Yang, F. (2014). Improve the efficiency of logistics and transportation Standardization and innovation as the first business value v2b discussion on transportation standardization and logistics innovation. Transportation World (transportation. Vehicles) (4), 28-35.

Wang-You, W. U. . (2019). Research on e-commerce logistics of fresh fruit based on railway and postal cooperation. storage and process.

Wang, Z. Z., & Liu, X. Y. (2014). Comprehensive cost-benefit analysis based on the performance of drop and pull transport. Applied Mechanics & Materials, 505-506, 501-506.

Wei, H. L., Wong, Christina W.Y., & Lai, Kee-hung. (2012). Linking inter-organizational trust with logistics information integration and partner cooperation under environmental uncertainty. International Journal of Production Economics, 139(2), 642-653.

Wei, J. (2017). Current problems and countermeasures of automobile dispatch management. Times car (10), 26-27.

Wei, S., & Dai, M. (2014). Multi-agent cooperative e-commerce recommender system model. Journal of Computer Applications.

Wei, T., Li, Q., Chang, X., Yang, Y., & Zhu, J. (2015). A Spatio-Temporal Decision Support Framework for Large Scale Logistics Distribution in the Metropolitan Area. Advances in Spatial Data Handling and Analysis.

Weiss, J. (2001). Project Management Process in Early Stage E-Businesses: Strategies for Leading and Managing Teams. Hawaii International Conference on System Sciences.

Weitao, L., Hong, G., & Chunhong, L. (2011). Expert evaluation method based on Delphi method. computer engineering (s1), 189-191.

Weißhuhn, S., Lemmen, S., & Fröhlich, E. (2017). Optimal Regional Distribution Center Location of Technology Companies in Eastern Europe: A Quantitative and Qualitative Perspective. Supply Management Research.

Weltevreden, J. W. J. (2008). B2c e - commerce logistics: the rise of collection - and - delivery points in the netherlands. International Journal of Retail & Distribution Management, 36(8), 638-660.

Wen, J., Zhan, B., & Zhang, X. H. (2014). Research and application of activity-based costing in drop and pull transport enterprises cost management. Applied Mechanics & Materials, 587-589, 1888-1891.

Wen, M. (2016). Research on Imported b2c e-commerce logistics model. Logistics technology, 35(5), 6-11.

Wierenga, B. , Bruggen, G. V. , & Althuizen, N. . (2008). Advances in marketing management support systems.

Wilkinson, M. E., Quinn, P. F., Barber, N. J., & Jonczyk, J. (2014). A framework for managing runoff and pollution in the rural landscape using a catchment systems engineering approach. Science of the Total Environment, 468-469(7484), 1245-1254.

Wilson, C. S., & Atkins, P. B. (2007). The contribution of goal setting to the success of eCommerce systems among small and medium enterprises. Complex analysis and dynamical systems .

Wippler, J. L. (2016). Complex systems and systems of systems engineering.

Wojtek, R. (2015). E-commerce and the Return of Unwanted Goods: A Case for Cooperation Among Providers of Postal and Non-postal Parcel Services. Postal and Delivery Innovation in the Digital Economy.

Wolfgang W. Osterhage. (2014). Project Organisation. IT Quality Management.

Wong, J. T. (2010). The distribution processing and replenishment policy of the supply chain under asymmetric information and deterioration: insight into the information value. Expert Systems with Applications,37(3), 2347-2353.

Wu, I. L., & Wu, S. M. (2015). A strategy-based model for implementing channel integration in e-commerce. Internet Research, 25(2), 239-261.

Wu, J. H., & Wang, Y. M. (2006). Development of a tool for selecting mobile shopping site: a customer perspective. Electronic Commerce Research & Applications, 5(3), 192-200.

Wu, P. J. , & Lin, K. C. . (2018). Unstructured big data analytics for retrieving e-commerce logistics knowledge. Telematics and Informatics,35(1), 237-244.

Wu, Q. (2016). Big e-commerce: a new concept for e-commerce in the era of "internet + ". Journal of Nanjing University of Posts and Telecommunications: Social Science Edition,018(001), 31-38.

Wu, R & Han, B. (2004). Application of fuzzy theory in the assessment of projects' uncertainty. Computer Engineering.

Wu, S., & Yu, B. (2016). Research on the cooperative development path of e-commerce and express logistics. Management review, 28(7), 93-101.

Wu, X., & Brooks, B. R. (2003). Self-guided langevin dynamics simulation method. Chemical Physics Letters, 381(3), 512-518.

Wu, X. S. (2003). Design and implementation of a digitized warehouse remote monitoring system. Journal of South China University of Technology, 31(9), 31-34.

Wu, X., Ji, S. W., & Nan, L. (2014). Data processing in optimization and design of regional layout based on pharmaceutical logistics distribution center. Applied Mechanics & Materials, 685, 740-743.

Wu, Y, & Gao, B. (2016). Research on the collaborative development of China's e-commerce and logistics industry. Journal of Luoyang Normal University, 35(2), 75-79.

Xia, L. (2007). Research on value chain strategy of enterprises in e-commerce environment. Reform and strategy (3), 107-110.

Xiao, J., Xuan, Z., Lin, H., & Lin, L. P. (2011). A method of collaborative multi-path load forecasting based on maximum entropy principle. China International Conference on Electricity Distribution.

Xiao, Z., Zhang, W., Li, Q., Lei, L., & Cui, L. (2015). A Method of E-Commerce Trading Process Construction Based on PaaS Platform. IEEE International Conference on E-business Engineering.

Xiao, Z. S., Wei, H., Li, T., & Cui, L. Z. (2014). A context-based collaboration supported framework for E-commerce PaaS platform. IEEE International Conference on Computer Supported Cooperative Work in Design.

Xie, C. . (2019). Research on the Collaboration of Cross-border E-commerce and Cross-border Logistics in Shaanxi Province FTZ.

Xie, D. (2017). Development Status and Thinking of "Internet +" Car Matching Platform. Modern Industry (11), 44-45.

Xie, M. (2017). Analysis of the influence mechanism of B2C e-commerce enterprise-customer interaction on customer experience. Science and Technology Journal: Electronic Edition (11), 227.

Xie, Y. (2017). Understanding design science, research design science. Science and technology guide.

Xinchun Zhou, & Weina Fu. (2019). A multi-agent simulation method of urban land layout structure based on fpga. Mobile Networks and Applications(1).

XING Da-ning, ZHAO Qi-lan, & SONG Zhi-gang. (2016). A study of service model innovation for logistics information platform based on cloud ecosystem. Journal of Business Economics.

Xiong, L., & Liu, L. (2004). Peertrust: Supporting reputation-based trust for peer-to-peer electronic communities. IEEE transactions on Knowledge and Data Engineering, 16(7), 843-857.

Xiong, S., Na, W., Li, K., Duan, P., & Yu, F. (2016). Design of Distributed Logistics Vehicle Monitoring System with High Load.

Xiong, Z. K., Wan, P. Z., & Cai, J. P. (2014). Study on e-commerce platform operation mechanism in big data environmen. Applied Mechanics & Materials, 687-691, 2776-2779.

Xiujuan, L. I., Yang, Y., Jiang, J., & Jiang, L. (2013). Application of ant colony optimization to logistics vehicle dispatching system. Journal of Computer Applications, 33(33), 2822-2826.

Xiuying, Z. . (2016). Research on the construction of collaborative e-commerce platform for shanxi tourism industry. Agriculture Network Information.

Xu, H., Ke, L., & Fan, G. (2017). Novel Model of E-Commerce Marketing Based on Big Data Analysis and Processing. International Conference on Computer Network.

Xu, L., Fang, Zh., & Liu, S. (2013). Optimization of supply Chain management of complex products based on Design Structure Matrix. Operations and management, 22(1), 106-111.

Xu, SX, & Huang, GQ. (2017). Efficient multi-attribute multi-unit auctions for b2b e-commerce logistics. Production & Operations Management,26(2).

Xu, X., Wei, Z., Ning, L., & Xu, H. (2015). A bi-level programming model of resource matching for collaborative logistics network in supply uncertainty environment ☆. Journal of the Franklin Institute, 352(9), S0016003215000393.

Xu, Y. (2018). Security analysis of e-commerce payment and online banking transactions. Modern economic information (7), 339+341.

Xu, Y., Yang, B. Y., & Shi, H. R. (2013). Mechanism and pattern of developing rural logistics. Applied Mechanics & Materials, 409-410, 1147-1153.

Xu, Z., Ming, X. G., Song, W., He, L., & Miao, L. (2014). Collaborative project management: a systemic approach to heavy equipment manufacturing project management. Systemic Practice & Action Research, 27(2), 141-164.

Xue, W. (2016). Intelligent mining on purchase information and recommendation system for e-commerce. IEEE International Conference on Industrial Engineering & Engineering Management.

Ya-Jie, Z. . (2019). The research on the collaborative development path of e-commerce with characteristics agricultural products in northern anhui province. Journal of Changchun Institute of Technology(Social Sciences Edition).

Yadav, R. , & Bhatnagar, S. . (2020). Channel Collaboration in E-commerce: A Study on Channel Relationship from the Perspective of Vendors Selling on Online Platforms, the E-retailers. Transforming Organizations Through Flexible Systems Management.

Yan, L. I. , & Qiao-Shu, L. U. . (2018). Research on cross-border e-commerce and cross-border logistics development of hunan agricultural products under the "one belt and one road" initiative. Logistics Engineering and Management.

Yang, J., Yang, Ch, & Yao, X. (2014). Research on the "last mile" problem in e-commerce logistics. Business economy and management (4), 16-22.

Yang, Sh. (2010). Research on the Management Model of YCL Cold Supply Chain Transportation. (Doctoral dissertation, Lanzhou University).

Yang, X. Q. (2014). An Intelligent E-Commerce Recommendation Algorithm Based on Collaborative Filtering Technology. International Conference on Intelligent Computation Technology & Automation.

Yang, X., Pan, T., & Shen, J. (2010). On 3G mobile E-commerce platform based on Cloud Computing. IEEE International Conference on Ubi-media Computing.

Yang, Y. (2016). Research on e-commerce model of agricultural products based on cooperatives. Modern commerce (17), 36-37.

Yang, Y, & Chen, J. (2005). Telecommunication service decision support system based on data mining. Information science, 23(10), 1535-1537.

Yang, Y., Chen, J. H., & Cao, X. Y. (2005). Coordinated logistics system under electronic commerce. Commercial Research.

Yao, W. (2005). Logistics network structure and design for a closed-loop supply chain in e-commerce. International Journal of Business Performance Management, 7(4), 370-380.

Yao, Z. Q., Zhu, Heng Jun, & Du, Wen He. (2014). Design and implementation of automated warehouse monitoring system based on the internet of things. Applied Mechanics & Materials, 543-547, 1099-1102.

Ye, L. (2015). Development of Intelligent Vehicle Dispatching Management System. Technological horizon (23), 68-68.

Yifei, X, & Xiaowen, T. (2014). Research on the Development of Microfinance Based on E-commerce Platform——Taking Ali Small Loan as an Example. Knowledge economy (1), 68-69.

Yin, J. (2017). The new mode of e-commerce logistics - container transportation. Special car (6), 30-32.

Yin, Zh, & Ye, Ch. (2014). Hierarchical Algorithm Model for Vehicle Scheduling Problem of Multi-Distribution Center Logistics Distribution. Journal of Systems Management (4), 602-606.

Ying, Y. U., Xin, W., Zhong, R. Y., & Huang, G. Q. (2017). E-commerce logistics in supply chain management: implementations and future perspective in furniture industry. Industrial Management & Data Systems(4), 00-00.

Ying, Y., Xin, W., Zhong, R. Y., & Huang, G. Q. (2016). E-commerce logistics in supply chain management: practice perspective ☆. Procedia Cirp, 52, 179-185.

Yu, F. L. T. . (2018). Private enterprise development in a one-party autocratic state: the case of alibaba group in china's e-commerce. Issues & Studies, 54(01).

Yu, L., Lin, L., & Chen, B. (2014). Vehicle scheduling problem in network-type transport mode. Journal of Transportation Engineering and Information (2), 58-64.

Yu, K., Cadeaux, J., & Hua, S. (2017). Flexibility and quality in logistics and relationships. Industrial Marketing Management, 62(3), 211-225.

Yu, T. (2015). Research and application of vehicle scheduling optimization in logistics enterprises. (Doctoral dissertation, Zhejiang Ocean University).

Yu, X., Guo, S., Guo, J., & Huang, X. (2011). Rank b2c e-commerce websites in e-alliance based on ahp and fuzzy topsis. Expert Systems with Applications An International Journal, 38(4), 3550-3557.

Yu, Y. (2016). A research on construction logic and synergistic mechanism of e-commerce ecosystem in the era of big data. Journal of North China University of Water Resources & Electric Power.

Yuan. (2016). Research on the logistics cost and enterprise operation efficiency with the influences on international trade. (3), 66-68.

Yang, H., Chen, X., Li, J., & Cao, Y. (2017). Design of instant messaging system of multi-language e-commerce platform.

Yuan, K., & Guo, Y. (2017). "Internet + Farmer Professional Cooperative" Constructs Modern Agricultural Logistics System. Journal of Hubei University of Arts and Science (9), 36-42.

Yuan, P., Zhang, X., & Zhu, Ke. (2015). Analysis on the cultivation path of Yunnan agricultural e-commerce cooperatives. Contemporary economy (23), 74-76.

Yuan, Q., Shen, Y., & Feng, L. (2011). The Study on Trust Management Model Based on Probability in Distributed E-Commerce System. Computing and Intelligent Systems.

Yuan, Q., Ying, M. A., & University, H. U. (2018). Research on the construction of e-commerce marketing platform for agricultural products in big data era. The Journal of Shandong Agriculture and Engineering University.

Yuan, W., Jiang, X., Lee, L. H., Chew, E. P., & Tan, K. C. (2017). Tree based searching approaches for integrated vehicle dispatching and container allocation in a transshipment hub. Expert Systems with Applications, 74, 139-150.

Yuan, X., & Fernandez, E. B. (2011). Patterns for business-to-consumer e-commerce applications. International Journal of Software Engineering & Applications, 2(3).

Yuan, Y., Gao, H., & University, J. (2017). Study on terminal distribution of e-commerce logistics with time windows. Journal of Hubei University for Nationalities.

Zeng, M. (2016). "Internet +" background b2c e-commerce return reverse logistics strategy analysis. Times Finance (12).

Zeng, X. (2014). Batch-based and cost-considered production logistics distribution strategy for manufacturing enterprises. Logistics Technology.

Zeng, X., & Wang, Zh. (2011). Research on logistics project risk management based on modern project management theory. Logistics Engineering and Management, 33(2), 27-29.

Zhai, Y. (2015). Standardization of urban distribution vehicles. China Logistics and Purchasing (14), 44-45.

Zhang, & Ying. (2013). Rfid/gps/gprs-based logistics monitoring and management system. Applied Mechanics & Materials, 380-384, 871-874.

Zhang, Ch, & Yan, G. (2012). Research on project schedule model based on Design Structure Matrix. Technology and management, 14(3), 38-41.

Zhang, D. (2012). Project Design of Tourism E-commerce System for Sanqing Mountain Based on Customer Relationship Management. Fourth International Conference on Multimedia Information Networking & Security.

Zhang, D., Sha, L., & Fei, W. (2010). Cooperation quality supervision and coordination in two-stage supply chain of agricultural product logistics service. IEEE International Conference on Grey Systems & Intelligent Services.

Zhang, D., Yang, Z., & Yao, J. (2006). Research on elimination the correlation of service evaluating index in distribution e-commerce. Journal of Tongji University, 34(3), 401-404.

Zhang, D., Zhan, Q., Chen, Y., & Li, S. (2016). Joint optimization of logistics infrastructure investments and subsidies in a regional logistics network with co 2 emission reduction targets. Transportation Research Part D Transport & Environment, S1361920916000286.

Zhang, F., Ni, W., Cao, J., & Lin, J,. (2015). Research on the Problems and Countermeasures in the Development of Express Delivery Cabinets in China. Logistics technology, 38(7), 46-48.

Zhang, H. (2017). Problems and countermeasures of logistics distribution in e-commerce. Manager (03), 255.

Zhang, H, & Wang, W. (2004). Analysis of Vehicle Overrun, Overload and Road Transportation Safety. Highway transportation technology, 21(3), 132-136.

Zhang, J. (2013). Reflections on the Development of Educational Technology Research in the United States-Design Science Perspective. Peking University Education Review, 11(3), 32-48.

Zhang, J., Wang, X., & Huang, K. (2016). Integrated on-line scheduling of order batching and delivery under b2c e-commerce. Computers & Industrial Engineering, 94(C), 280-289.

Zhang, J., Wang, Y., & Bai, L. (2016). Research on collaborative management mode of construction project based on information sharing. Journal of Engineering Management, 30(2), 91-96.

Zhang, J., Zhao, Y, & Yu, H. (2013). Research on user experience evaluation of B2C e-commerce website. Information science (12), 84-89.

Zhang, L., & Shi, F. (2008). An analysis on the relationship between modern logistics and e-commerce. IEEE International Conference on Service Operations & Logistics.

Zhang, L. W., Zhu, M. J., & Li, G. J. (2013). Research on drop and pull transportation cost of entire car. Advanced Materials Research, 779-780, 977-980.

Zhang, M. (2017). Optimal transportation service trading mechanism in e-commerce logistics.

Zhang, M, & Liu, K. (2016). Research on Terminal Logistics Distribution Mode Based on Self-reporting Cabinet. Hebei enterprise (5), 96-97.

Zhang, M., Pratap, S., Huang, G. Q., & Zhao, Z. (2017). Optimal collaborative transportation service trading in b2b e-commerce logistics. International Journal of Production Research, 55, 1-17.

Zhang, N., Wang, L., Li, Ch., Meng, R., & Zhao, H. (2017). Research on the e-commerce mode of farmers' professional cooperatives under the background of "Internet +". E-commerce (2), 28-30.

Zhang, P. (2017). Reduce cost and increase efficiency and promote the development of intelligent logistics standardization——Interview with Wang Jian, Comprehensive Transportation Research Center, Ministry of Transport, China. China Standardization (15), 9-12.

Zhang, P., Jian, M., & Long, Y. (2012). Research on Layout Evaluation Indexes System of Dangerous Goods Logistics Port Based on AHP. Software Engineering and Knowledge Engineering: Theory and Practice.

Zhang, P. C., Shi, Z. K., & Xu, M. (2006). Design and implementation of vehicle monitoring system based on gprs. Journal of Wuhan University of Technology, 6, 3574-3578 Vol. 6.

Zhang, Q. (2013). Study on Fuzzy Comprehensive Evaluation Model Based on Xiangjiang Shipping Safety.

Zhang, Q. Y., Chen, J. H., & Tao, Y. M. (2012). Researches on joint distribution in urban logistics. Advanced Materials Research, 472-475, 3240-3243.

Zhang, Q., Yang, J., Song, C., & Ying, Y. (2009). Research on the Architecture of Iron and Steel Logistics E-Commerce System. International Conference on Management & Service Science.

Zhang, W., (2017). Modern project management theory and application. Equipment supervision (1), 22-26.

Zhang, X. (2014). Project Management Control. Enterprise Management Control Systems in China.

Zhang, X., & Ma, T. (2015). The dilemma of cross-border e-commerce logistics in China and suggestions. Contemporary economic management, 37(5), 51-54.

Zhang, Y. (2011). Application research of project management theory in innovation and entrepreneurship project——taking Liaoning University as an example. (Doctoral dissertation, Jilin University).

Zhang, Zh. (2013). Collaborative management mechanism of dynamic alliance cooperation project under e-commerce environment. Chinese business theory (10).

Zhao, C., Mai, J., & He, Z. (2011). The design of E-commerce system architecture based on Struts2, Spring and Hibernate. International Conference on Information Science & Engineering.

Zhao, J. (2010). Developing the cloud platform supporting the operations of the internet of things. Telecommunications Science(1), 57-68.

Zhao, J. (2011). The E-Business Development Trends in China Online Shopping Industry. Advances in Information Technology and Education.

Zhao, L., & Guo, Y. (2010). A summary of research on multi-channel distribution system under B2C e-commerce mode. Management review, 22(2), 69-78.

Zhao, Sh., Zhang, D., & Fang, Yi. (2015). Research on the construction of rural logistics service network in Jilin Province based on information technology. Information science (5), 53-57.

Zhao, T. (2016). Learning from cainiao network for refined oil logistics. International Petrleum Economics.

Zhao, W. (2017). Semi-trailer ride comfort and road friendliness with tops. (Doctoral dissertation, Lanzhou Jiaotong University).

Zhao, W. Q., Han, F. F., Cai, R., & Wang, D. W. (2014). E-commerce collaborative filtering algorithm research based on cloud computing. Advanced Materials Research, 846-847(846-847), 1566-1569.

Zhao, X. (2015). Research on O2O E-commerce Model. Value Engineering, 34(9), 280-281.

Zhao, X. (2015). Application of Autoload Pro in the design of loading scheme. Logistics technology, 34(10), 153-156.

Zhao, X. (2015). On the o2o e-commerce mode. Value Engineering.

Zhao, X. (2013). Research and Practice on the Integration of D Group Logistics Evaluation Index System. (Doctoral dissertation, Shanghai Jiaotong University).

Zhao, X., Jin, F., Min, J., Jian, W., & Zhang, Z. (2010). E-Commerce and Aided Decision Support System of Logistics Based on Spatial Web Services. International Conference on E-business & E-government.

Zhao, Z., Fang, J., Huang, G. Q., & Zhang, M. (2017). Location management of cloud forklifts in finished product warehouse. International Journal of Intelligent Systems, 32(4).

Zhao, Z., & Zhan, Y. (2009). A cost analysis method on location planning for logistics distribution network system. International Conference on Industrial Engineering & Engineering Management.

Zhengdong, H. U., Xiamiao, L. I., & Lihua, L. I. (2012). Model and algorithm for nodes decision of medicine logistics alliance under cooperative game. Computer Engineering & Applications.

Zheng, J. (2017). International container shipping market: supply and demand are under pressure. China Ocean Shipping (4), 16.

Zhong, H. L., Guo, W. X., Zhang, G. X., & Cai, W. X. (2013). Research on vehicle schedule problem for drop and pull transport of port. Advanced Materials Research, 684, 621-625.

Zhong, R. Y., Lan, Shulin, Xu, Chen, Dai, Qingyun, & Huang, George Q. (2016). Visualization of rfid-enabled shopfloor logistics big data in cloud manufacturing. International Journal of Advanced Manufacturing Technology, 84(1-4), 5-16.

Zhong, X, Liu, X, & Sun, X. (2005). Research on the running speed model of medium truck based on the consistency of highway route design. Highway transportation technology, 22(3), 92-96.

Zhou, C. (2005). Research on optimize method of logistics delivery route. Journal of Wuhan University of Technology.

Zhou, C, & Wang, L. (2018). The world's first driverless electric truck port trial operation. Heavy vehicle, No.164(2), 29.

Zhou, J., & Shan, Y. (2012). Research on theory and method of large-scale engineering project management. Shanxi Architecture,38(20), 269-270.

ZHOU Lue-lue, & WEI Yu-guang. (2013). Soft time window associated model and algorithm for the vehicles routing problem of logistics distribution center. Shandong Science.

Zhou, M. , Ding, Z. , Tang, J. , & Yin, D. . (2018). Micro Behaviors: A New Perspective in E-commerce Recommender Systems. the Eleventh ACM International Conference. ACM.

Zhou, X., & Wu, Y. (2010). Research on e-commerce model of network group purchase. Scientific information (20), 215-215.

Zhuang, Q. (2012). A Brief Discussion on the Research Design in Social Science Research. Social Science Management and Review (1), 11-17.

Zhu, B., & Song, Y. (2016). Spatial aggregation pattern and influencing factors of "taobao village" in china under the c2c e-commerce mode%c2c. Economic geography, 036(004), 92-98.

Zhu, G., Zhu, Z. F., Zhao, J., & Zhu, Y. Q. (2014). Creative distribution mode design of terminal logistics based on new technological environment. Advanced Materials Research, 1073-1076, 2390-2397.

Zhu, H. (2014). Problems and countermeasures in vehicle dispatch management. Technological innovation and application (1), 270-270.

Zhu, H., Sun, L., Gong Juntao. (2006). Analytic network process and application for member selection in logistics alliance. China Mechanical Engineering, 17(18), 1913-1915

Zhu, J. (2011). Notice of RetractionThe collaborative management of B2C e-commerce and logistics distribution. International Conference on E-business & E-government.

Zhu, K. (2004). The complementarity of information technology infrastructure and e-commerce capability: a resource-based assessment of their business value. Journal of Management Information Systems,21(1), 167-202.

Zhu, P. (2016). Research on modelling the collaborative management of e-commerce and logistics under the big data era. Logistics Engineering & Management.

Zhu, S. (2016). Optimization of loading and unloading resource scheduling for railway container central station based on train arrival time constraints. (Doctoral dissertation, Beijing Jiaotong University).

Zhu, S. H., & Shi, Q. M. (2014). Research of third-party e-commerce risk and measures. Advanced Materials Research, 926-930, 3882-3885.

Zhu, Y. (2018). innovation of logistics management in e-commerce environment. Logistics Engineering and Management , 040(001), 44-45.

Zhu, Z. (2011). The main data release of the sixth national census. Middle school political history (applicable to junior high school) (Z2), 55-58.

Zio, E. (2014). The Monte Carlo Simulation Method for System Reliability and Risk Analysis.

Zong, X., & Shao, H. (2017). Design of cold chain logistics remote monitoring system based on zigbee and gps location.

Zong, Zh., Nie, Zh., & Zhang, Zh. (2014). Research on Parameter Identification of Simplified Model of Van Semi-trailer. China Journal of Highways, 27(4), 112-120.

Zuo, W., Huang, Q., Fan, C., & Zhang, Z. (2013). Quality management of b2c e-commerce service based on human factors engineering. Electronic Commerce Research & Applications, 12(5), 309-320.