

BRINGING STRATEGIC THINKING TO A CHINESE TOBACCO LOGISTICS CENTER

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<p>Abstract</p> <p>Recently operation and logistics activities have played a more strategic role as tobacco business enterprises' main functions. Because of the increasing costs of e.g. warehousing and inventory, transportation, personnel and other relevant materials, the different parties in the supply chain are facing more challenges and opportunities. On the one hand, this brings about improvements to the process flow and communications within the logistics activities for the sake of saving materials and more competitiveness in the fierce competition. On the other hand, this leads to developing a more efficient supply chain in order to fulfill the customers' requirements and gain more achievements.</p> <p>The core purpose of this thesis was to propose a strategic framework to improve the performance of the Chinese tobacco supply chain. Furthermore, this thesis was to give solutions to designing a new process flow for tobacco logistics activities in order to promote their efficiency and integrated resources. This thesis was focused on two main types of directions, internal and external.</p> <p>The Internet of Things applications have made the tobacco supply chain more effective and provided better performance. It also gives more opportunities for communication and connections between the different parties in the supply chain. Building the Tobacco Internet of Things is one trend for the future development in the Chinese tobacco market. It could monitor and control all the parties in tobacco supply chain by using RFID, GIS, GPS and other relevant sensors and technologies. Meanwhile, the internal department integration has made logistics activities more competitive and achieved Just-in-time delivery targets. Strategic thinking is one of the most important issues in order to improve the internal and external tobacco logistics.</p>		
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1 BACKGROUND AND INTRODUCTION

The Chinese tobacco business is one contributor to the Chinese economy. More than 10 percent of the country's annual total revenue is from the tobacco business. Chinese tobacco business plays a significant role in the economy of the whole country. There is a saying about three titles of 'one third' in the Chinese tobacco market. They are three hundred million smokers who account for one third of the smokers all over the world; the sales of the Chinese tobacco leaf and finished products which occupy one third of the sales all over the world. Meanwhile, the China tobacco business holds 'eight most' titles in world class: plant areas of cured tobacco, output of cured tobacco, increase in cured tobacco, sales of finished products, increase in finished products, smokers, increase in smokers, and increase in tobacco revenues.

Since China attended in World Trade Organization (WTO) and assigned World Health Organization Framework Convention on Tobacco Control (WHO FCTC) in the year 2003, many challenges and opportunities have been coming forth. On the one hand, more and more companies which monopolized the market previously has now changed to face an open market. It means that the China tobacco business should go to free and international competition with the same kind of tobacco companies globally at present and in the future. On the other hand, given rapid development and state policy in the Chinese tobacco business, opportunities will emerge during the future years in order to consummate and take better performance for global competition. Therefore, the reformation of Chinese tobacco business enterprises is imperative.

Chapter 1.1 presents basic information and relationships in tobacco enterprises including industrial and commercial type of companies. Chapter 1.2 discusses functions, processing and enabling technologies applied to the tobacco supply chain.

1.1 Basic Logistics Information of a Tobacco Enterprise

Since the year 2006, the tobacco industry has held tobacco logistics meetings in Chongqing, Anhui, Shanghai, Jiangsu, whose provinces are important areas in tobacco planting and producing. Moreover, managers, engineers and professors have been to logistics centers to do reviews and analysis. Furthermore, officers also coordinate them for better performance in competition and development. There is some basic information discussed below.

Tobacco commercial logistics system is already built up

A commercial tobacco enterprise focuses on commercial activities such as sorting, handling of orders, and sales. The working object is the finished tobacco products.

These years, commercial logistics infrastructures and operations are on a high level. As of May 2010, the tobacco commercial logistics system has included 356 logistics centers, 1102 transfer stations, 1276 tobacco sorting lines, 15027 delivery vehicles and 40722 delivery routes. Many provinces make plans and regulations for logistics systems. They are considering integrations of resources, optimizations of routes, control of expenses and promotion of services. In 2009, single-box logistics costs for the whole tobacco commercial enterprise were 163.61 Yuan, which increased by 10.83 Yuan per box by 7.08 percent; the rate of the logistics costs was 1.19 percent, which decreased by 0.03 percent; the number of logistics operators was 54816, which decreased by 1716, 3.03 percent; the number of delivery vehicles was 16840, which decrease by 694, 2.86 percent, and the vehicle mileage was 372 million, which decreased by 12.56 million by 3.27 percentages.

Tobacco industrial enterprise logistics construction is showing better performance

Tobacco industrial enterprise logistics focuses on making tobacco products from raw materials to finished ones. After that, the final tobacco products will be delivered into tobacco commercial enterprises.

With innovations for industrial enterprises, new services and good performances are being made. Many enterprises pay more attention to logistics activities. The Zhengjiang province tobacco industry and Shanghai tobacco industry actively pursue fresh models for vendor managed inventory and online packing; the Guizhou tobacco industry and Anhui tobacco industry set up a special logistics sector taking charge of professional logistics activities, which is separated from the sales and supply departments. They are focusing on an entire processing system which decreases the number of workers and various procedures.

Logistics connected-commercial and industrial enterprises have new breakthroughs

Some commercial and industrial enterprises in logistics integration do adventurous attempts and useful explorations. They are willing to share resources information in order to reduce duplication of investment and waste of resources.

As of May 2010, commercial and industrial enterprises share 26 warehouse plots, of which 10 plots that a commercial enterprise rents from an industrial enterprise, and 16 plots that an industrial enterprise rents from a commercial enterprise reciprocally. Secondly, some enterprises are trying to find a new way for delivery by using the same pallet with electronic tags from industrial enterprises to commercial enterprises. By this way, they will improve efficiency for in-out storage and loading-unloading, and decrease broken pallets and tobacco packages.

Rules and regulations have improved steadily

The Tobacco association and Chinese state have published authoritative rules and

regulations for the tobacco business from producing to sales. And then, they are also attempting to construct information logistics.

The quality of the logistics team significantly improved during these years

The tobacco association and tobacco enterprises pay more attention to staffs. They carry out short-term schools and meetings for staffs who come from different departments and different provinces which own high or low services. As of May 2010, 400 staffs have got national logistics engineer certificates among around 60000 staffs.

1.2 Logistics in the Tobacco Supply Chain

According to the requirements from the customers and providing services to the customers, logistics is necessary and being taking the most important role in the tobacco supply chain. More market share and more customers can be gained only if logistics finds and sets up a way based on the customers' expectations and their satisfaction.

The tobacco supply chain contains four parts: industrial tobacco enterprises, commercial tobacco enterprises, wholesalers, and final customers. These four parts make a tobacco supply chain which is shown in Figure1.



FIGURE 1. Tobacco chain

During this tobacco chain, four parts are not only spontaneous continual procedures but also connected to each other circularly.

Industrial enterprises take charge of producing tobacco products. All the transportation of resources and finished products, as well as warehousing and inventory management is done by the logistics sector. With the technology development and hot competition, information logistics will be a key point for enterprises. Building a commercial and industrial information sharing platform is under construction. At present, the industrial and commercial enterprises are together exploring and attempting information logistics with sharing information in transit. AGV, barcode, RFID, automated warehouse, electronic labels, GPS and GIS, more and more new words keep appearing.

Commercial enterprises take charge of the marketing and sales of finished tobacco products. All tobacco products' transporting, storage and delivery are commonly operated by logistics and distribution centers. Combined with the industrial and commercial enterprises, the logistics network is reformed to start from producing the raw materials, which is the beginning part, and to end with delivering the final tobacco products, which as the ending part. The beginning part completes all the raw material transportation and storage, and when finished tobacco products are manufactured, they are then transferred to a commercial enterprise city logistics center or then from the city logistics center to county ones. The final part completes by transporting the finished tobacco products from logistics centers to wholesalers.

Wholesalers are the end of the products distribution channels. And they play a middle role connected with the products and customers. Building a retail network is one important and necessary activity for online sales. Wholesalers are a useful bridge linked upstream and downstream when they get feedbacks from final customers.

Final customers are becoming more and more 'captious' compared with earlier years. In previous years, people bought tobaccos just focusing on their entity value. But

these years, people who buy tobaccos pay more attention to their experiential value, which emphasizes and shows individual character. Based on these, to develop customers' loyalty and increase the market share, one way is to improve tobacco logistics services.

2 CASE STUDY

This case was to be made for the logistics center of Hangzhou Tobacco Company. This company was also the author's practical training place from October 2011 to March 2012 for approximately five months. I stayed in three departments doing daily work and cooperated with the other two departments during these five months.

I chose this case because I thought it was a topic worth studying. With the increasing demand and the future development, the logistics center should provide better services to customers with lower expenses. The aim of the study was to give some available and possible methods for improving this logistics center.

Chapter 2.1 presents information about the Hangzhou logistics center which is a case study to this thesis. Chapter 2.2 presents connections and influences inside departments and the structure of the Hangzhou tobacco logistics center. Chapter 2.3 shows the layout of the warehouse and the sorting areas of the Hangzhou tobacco logistics center, and the primary logistics activities in the reserved department, which is one core department in the whole enterprise.

2.1 Hangzhou Tobacco Logistics Center Information

The Logistics center is one section that belongs to Hangzhou tobacco commercial enterprise which is located in Hangzhou city in the north direction. This logistics center has around 200 employees which includes 60 outsourced employees doing sorting activities. The annual sales are around 400 thousand boxes. The working days per year are around 250 days, every day 8 hours. The sorting time per day is 6.5-7.5 hours. The available time for warehousing operations is regularly 9 hours and the maximum of 12 hours in busy seasons.

Based on forecasting the future demand, the number of the daily in-stock products is about 9990 pieces of tobacco products. The units of tobacco products are shown in one formula below

$$1 \text{ box} = 5 \text{ pieces} = 250 \text{ bars} = 2500 \text{ bags} = 50000 \text{ cigarettes}$$

The automation ratio is about 30% for automation and 70% for manpower. As for efficiency, the automated speed is 900 pieces per hour, by manpower it is approximately the same amount compared with the automated work, but with three workers at the same time.

The share of direct transportation in delivery is 91 percent, and of transit to a transfer station 9 percent. In direct transportation, the loading is about 70-90 pieces per one vehicle. In transit transportation, the loading is around 600 pieces per one vehicle.

The main target of the Hangzhou logistics center is to transport tobacco to the wholesalers in Hangzhou City, and secondly to delivery tobacco to transfer stations in the counties belonging to Hangzhou City.

2.2 Hangzhou Tobacco Logistics Center structure and connections

There are 5 departments in this logistics center. They are the affairs department, reserved department, equipment department, delivery department and finance department. In addition, the call center is a special organization which does not belong to this company by management but does cooperation. It is shown clearly in FIGURE 2 and FIGURE 3.

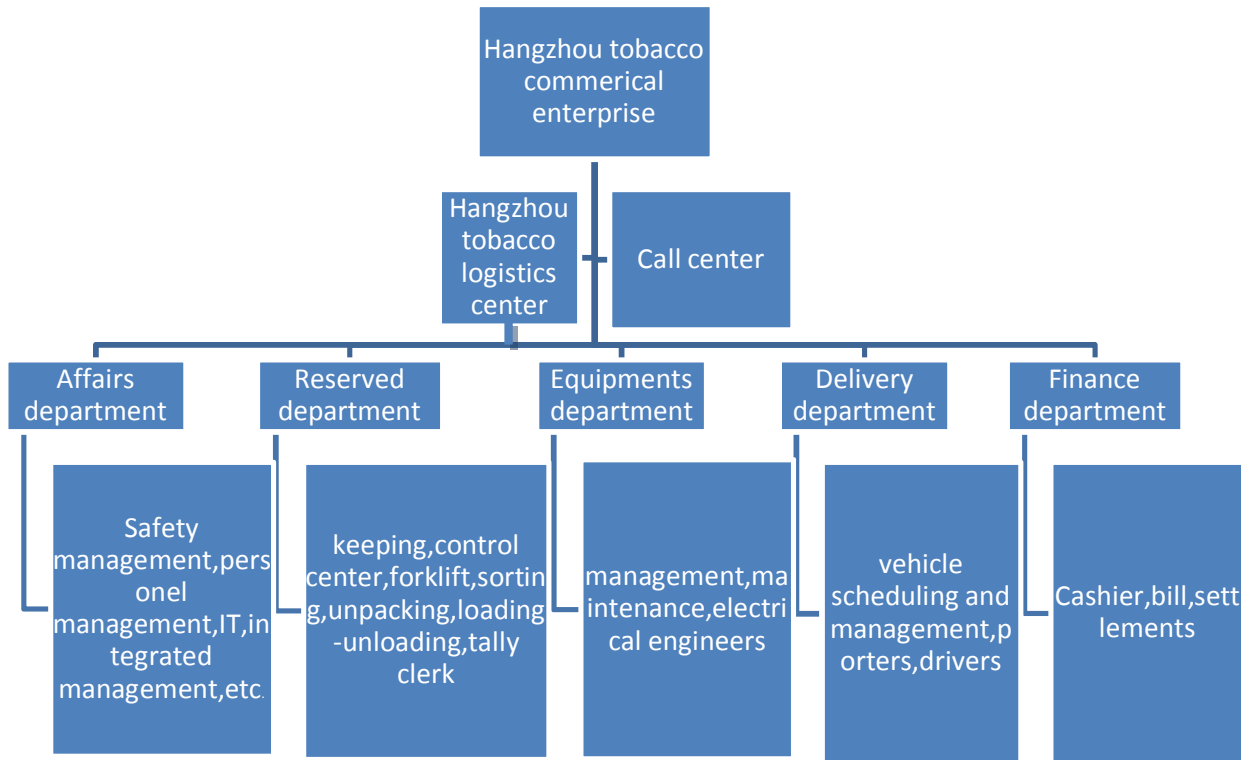


FIGURE 2. Hangzhou tobacco logistics center structure

These sections are working together. In the Hangzhou tobacco logistics center, the affairs department, finance department and call center are in the same building but on different floors. The reserved department is located in the warehouse and sorting areas in the 3-floor building. The delivery department is located across the street together with the parking areas and control offices.

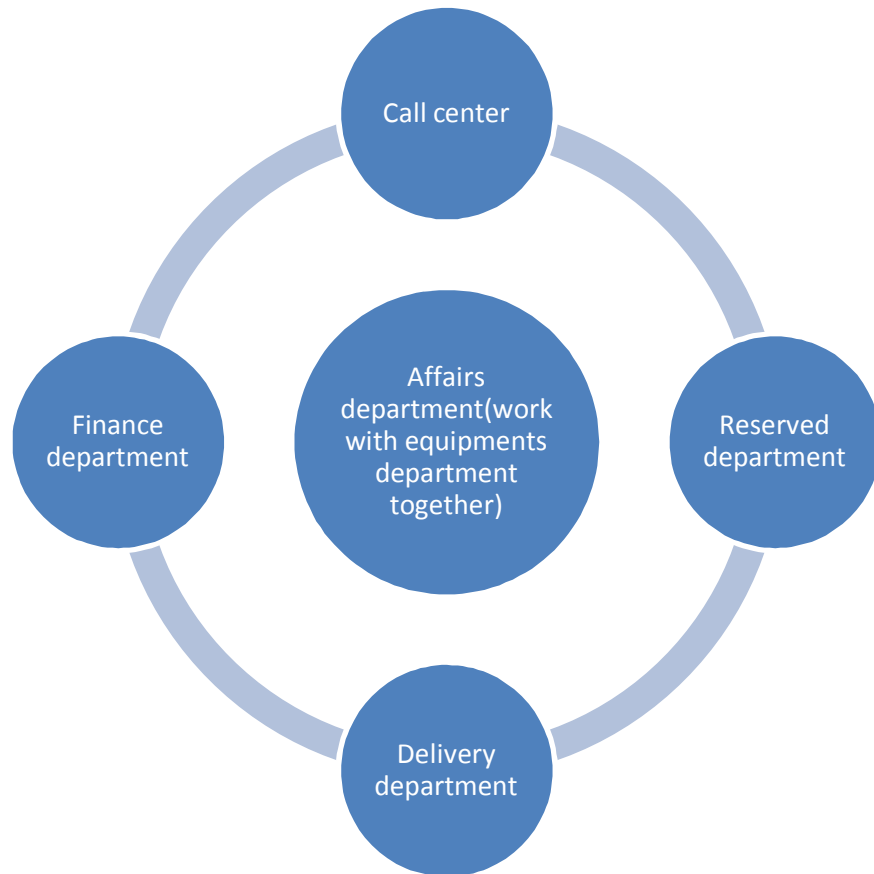


FIGURE 3. Internal connections in Hangzhou tobacco logistics center

2.3 Process Flow

This process flow is operating in warehouse and sorting areas mainly. The first thing is getting tobacco products from industrial enterprises or getting tobacco products from some other province. Then the products will be storage in the inventory, or make a JIT delivery. Then, according to dispatching orders and to sorting activities and delivery schedules, the last activity is transport to customers. The clear flow chart can be seen in FIGURE 4.

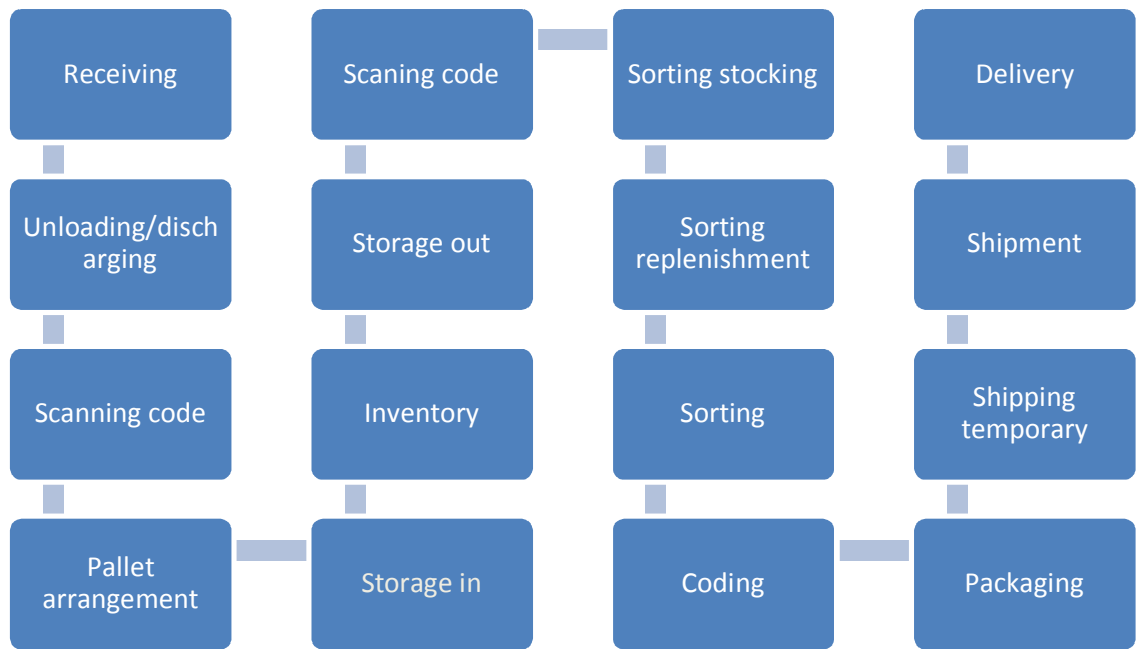


FIGURE 4. Regular model for tobacco logistics center process flow

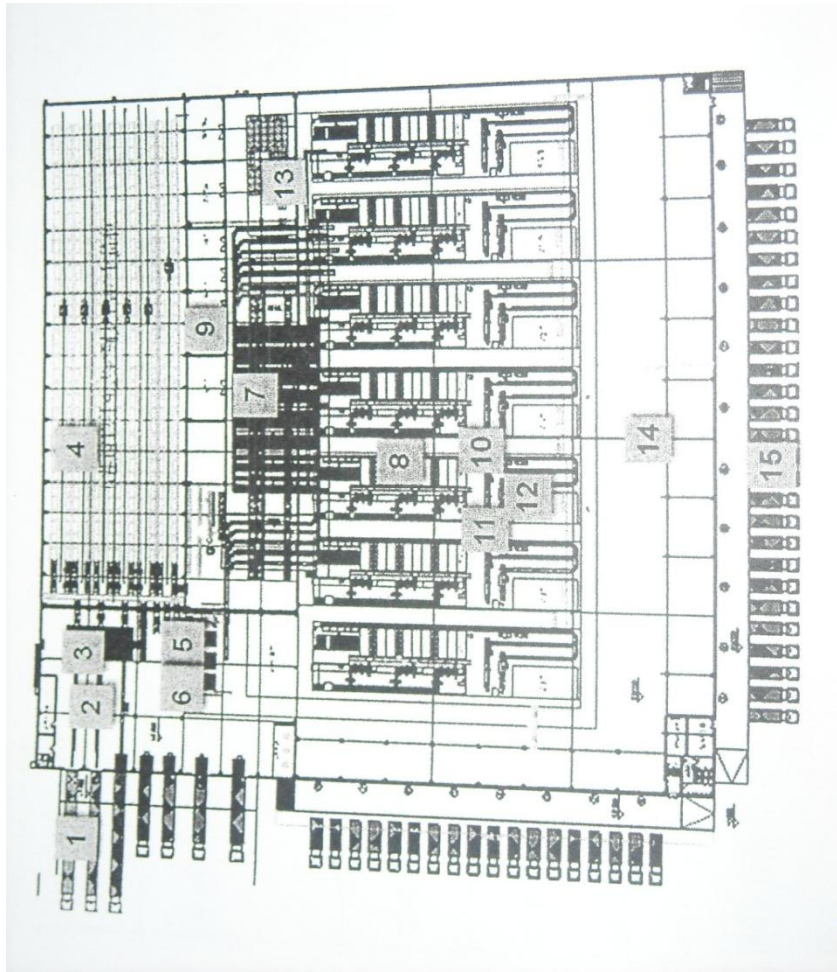


FIGURE 5. Hangzhou tobacco logistics center process flow in the warehousing area

FIGURE 5 shows the warehousing and sorting areas in one building on the first floor in the Hangzhou tobacco logistics center. The numbers present tasks and sequences:

1. Products arrive
2. Check products and scan bar code
3. Move products into warehouse
4. Warehouse storage
5. Move products out of warehouse
6. Scan bar code
7. Piece amount products storage
8. Bar amount products sorting (9. Piece amount or special products sorting)
10. Print bar code for bar amount products
11. Packaging
12. Labeled
13. Empty basket recycling
14. Temporary storage for transportation
15. Delivery

3 PROBLEMS STATEMENT

In the case of the Hangzhou tobacco logistics center, there are two major issues to exist which contain internal and external problems.

Section 3.1 discusses problems inside the Hangzhou tobacco logistics center. And section 3.2 analyses the issues in the whole tobacco supply chain.

3.1 Internal Problems

For the logistics center, the main target exists in such areas as warehousing inventory, sorting, and delivery and information management. And in these procedures, the most important core activity is sorting. This is because the aim of all efforts is supporting sorting in order to fulfill the customers' orders.

This part will influence the tobacco supply chain. On the other hand, sorting needs work connected with all the departments in the logistics center. But at present, the situation of the Hangzhou tobacco logistics center is not good enough to achieve goals with lower costs and more benefit as return. There are some obvious drawbacks which exist in the logistics center presented as follows.

Lower efficiency process flow issues based on time and cost

No standardization of pallets

No strong connections and sharing information within departments

3.2 External problems

Although tobacco business logistics has made great achievements and developed towards modern logistics in its embryonic form, it still has big gaps and imperfect aspects considering the requirements for future development. There are four external problems for the tobacco supply chain.

Scale of logistics operations is not in-depth

At present, compared with all the tobacco logistics centers based on city resources in different provinces, there still is a big difference. This difference perhaps presents itself in strategic, operational or management aspects. Thus, it prevents forming of an efficient and closed value chain. On the other hand, these logistics centers only take consideration of their own achievements and profits. It means they are selfish related to each other.

Integrated logistics is not full-scale

One essential and core part of integrated logistics is a full-scale network which connects tobacco industrial enterprises to final customers. In this issue, it lacks connections with not only departments but also with all objects in the tobacco supply chain. Secondly, it has no full and clear plans for cooperation and connections with the logistics network, especially with the industrial and commercial enterprises.

Tobacco logistics standardization has not yet been formed

Despite the fact that the tobacco business has some regulations and standards, it still has shortcomings in logistics operations and the whole procedures in the supply chain.

Intelligentized management has big difference in different provinces

The competitive power of logistics is in the development of Just In Time (JIT), intelligentized handling, data analysis and scale of logistics operations. All of these are based on intelligentized levels in the entire logistics network. But there still are many logistics centers which look down on intelligentized managements and strategies but look up on logistics centers' infrastructures and advanced facilities. On the other hand, the information logistics platform has not built up for the whole tobacco supply chain.

4 RESEARCH

Chapter 4.1 presents problems and goals of the case study and emphasizes the main points of focus. Chapter 4.2 presents research methods including qualitative and quantitative analysis for this case study.

4.1 Objectives

The main aim of this thesis was to build strategic frameworks in order to consummate the performance of the tobacco supply chain. The two main efforts were improving the operations in the logistics center and the integration of internal and external logistics activities. Tobacco industrial enterprises, tobacco commercial enterprises and wholesalers will be included. I will focus on these areas below.

Firstly, although the logistics center has good facilities and a sufficient process flow, based on future demands from marketing forecasting, more efficiency will be needed for sorting and warehousing areas and stronger connections between departments are needed.

Secondly, although this logistics center has a good performance in transporting, it still has no strong connections between the other two parties, which are tobacco industrial enterprises and tobacco commercial enterprises. The other two parties still use ordinary and old ways for operating. And in this tobacco supply chain, they do not have much information sharing. They are just interested in their own activities.

So in this thesis, strategic thinking was brought to the tobacco supply chain and frameworks for internal and external integration were built.

4.2 Research methods

In this thesis, case study and both qualitative and quantitative analysis methods were used.

For qualitative research studies, some interviews, observations and operations during my practical training were included. Some interviews with the persons were made from inside departments in the logistics center and with customers as well.

And for quantitative studies, some data was used and analysed such as annual demand, sorting and warehouse capacity. These numbers were taken from the company's internal documents.

5 THEORETICAL BASIS

For this chapter, the main contents are about relevant materials and literature related to the thesis. Section 5.1 introduces Internet of Things (IoT) its origin and development. Applications fields and barriers in future are shown as well. Section 5.2 discusses supply chain management applied in enterprises or in business fields and then analyses the objectives and benefits of the supply chain management.

5.1 Introduction to Internet Of Things (IoT)

5.1.1 IoT definition

The Internet of Things (IoT) is a novel paradigm that is rapidly gaining ground in the scenario of modern wireless telecommunications. The basic idea of this concept is the pervasive presence around us of a variety of things or objects – such as Radio-Frequency Identification (RFID) tags, sensors, actuators, mobile phones, etc., which through unique addressing schemes, are able to interact with each other and cooperate with their neighbors to reach common goals.

In the World Summit on the Information Society (WSIS) held in Tunis in 2005, the International Telecommunication Union (ITU) released a report entitled ‘The Internet of Things’ the annual report. It put forward a vision for any time, any place, any things connections in ubiquitous networks and ubiquitous computing.

5.1.2 Applied technologies

The implementation of The Internet of Things concept can be achieved through the

application of several technologies. Here the general concept of technologies related to Internet of Things is introduced rather than a special study on the technical aspects. References to the technical aspects can be found in professional technical books or other publications.

The Internet of Things is on the basis of the computer Internet, RFID, wireless data communications technology, constructed to cover everything in the world's "Internet of Things". In this network, the goods (products) are "exchanged" to each other without the need for human intervention. Its essence is the use of radio frequency identification (RFID) technology to achieve the interconnection and sharing of the automatic identification of goods (products) and information through the computer Internet. The Internet of Things is a very important technology which is based on radio frequency identification (RFID) technology. RFID is an automatic identification technology which began to rise in the 1990s. It is an advanced technology without contacting identification. The development of the RFID technology is based on a simple RFID system, which is combined with the existing network technology, database technology, and middleware technology, to build one network composed by a large number of networked readers and numerous mobile labels. RFID is a technique which is able to let items "speak". In the "Internet of Things" concept, in RFID tags is stored the specification and interoperability information collected automatically from wireless data communications network to a central information system, to achieve the identification of goods (products). And then through the open computer network for information exchange and sharing, items will be in "transparent" management.

The Internet of Things, through intelligent sense, identification technology and pervasive computing, and ubiquitous network convergence applications breaks the conventional thinking; human beings can achieve ubiquitous computing and network connections. Traditional thinking is always physical infrastructure and IT infrastructure is apart: one is represented by airports, roads, buildings, and the other by data centers, personal computers, broadband, etc. In the era of the "Internet of

Things", broadband will be integrated into a unified infrastructure, in this sense, the infrastructure is more like a new site of the Earth, which includes economic management, production operation, social management and even personal life. The "Internet of Things" makes much more refined and dynamic the management of production and life, and managing the future of the city to achieve the status of "wisdom" to improve resource utilization and productivity levels, and improve the relationship between man and nature.

The key components of the IoT will be RFID systems, which are composed of one or more reader(s) and several RFID tags. Tags are characterized by a unique identifier and are applied to objects (even persons or animals). Readers trigger the tag transmission by generating an appropriate signal, which represents a query for the possible presence of tags in the surrounding area and for the reception of their IDs. Accordingly, RFID systems can be used to monitor objects in real-time, without the need of being in line-of-sight; this allows for mapping the real world into the virtual world. Therefore, they can be used in an incredibly wide range of application scenarios, spanning from logistics to e-health and security. From a physical point of view, a RFID tag is a small microchip attached to an antenna (that is used for both receiving the reader signal and transmitting the tag ID) in a package which usually is similar to an adhesive sticker. Usually, RFID tags are passive, i.e., they do not have on-board power supplies and harvest the energy required for transmitting their ID from the query signal transmitted by a RFID reader in the proximity. In fact, this signal generates a current into the tag antenna by induction and such a current is utilized to supply the microchip which will transmit the tag ID. Usually, the gain (power of the signal received by the reader divided by the power of the signal transmitted by the same reader) characterizing such systems is very low. Obviously the radio coverage is the highest for active tags even if this is achieved at the expenses of higher production costs. Sensor networks will also play a crucial role in the IoT. In fact, they can cooperate with RFID systems to better track the status of things, i.e., their location, temperature, movements, etc. As such, they can augment the awareness of a certain environment and, thus, act as a further bridge between physical and digital

world. Usage of sensor networks has been proposed in several application scenarios, such as environmental monitoring, e-health, intelligent transportation systems, military, and industrial plant monitoring. Sensor networks consist of a certain number (which can be very high) of sensing nodes communicating in a wire-less environment. Usually nodes report the results of their sensing to a small number (in most cases, only one) of special nodes called sinks. A large scientific literature has been produced on sensor networks in the recent past; addressing several problems at all layers of the protocol stack. Design objectives of the proposed solutions are energy efficiency (which is the scarcest resource in most of the scenarios involving sensor networks), scalability (the number of nodes can be very high), reliability (the network may be used to report urgent alarm events), and robustness (sensor nodes are likely to be subject to failures for several reasons). RFID sensor networks are the possibility of supporting sensing, computing, and communication capabilities in a passive system.

The other key composed part is middleware. The middleware is a software layer between the technological and the application levels. Its feature of hiding the details of different technologies is fundamental to exempt the programmer from issues that are not directly pertinent to her/his focus, which is the development of the specific application enabled by the IoT infrastructures. The middleware is gaining more and more importance in the last years due to its major role in simplifying the development of new services and the integration of legacy technologies into new ones. This exempts the programmer from the exact knowledge of the variegated set of technologies adopted by the lower layers. The middleware architectures proposed in the last years for the IoT often follow the Service Oriented Architecture (SOA) approach. The adoption of the SOA principles allows for decomposing complex and monolithic systems into applications consisting of an ecosystem of simpler and well-defined components. The use of common interfaces and standard protocols gives a horizontal view of an enterprise system. Thus, the development of business processes enabled by the SOA is the result of the process of designing workflows of coordinated services, which eventually are associated with objects actions. This facilitates the interaction among the parts of an enterprise and allows for reducing the time necessary to adapt itself to

the changes imposed by the market evolution. A SOA approach also allows for software and hardware reusing, because it does not impose a specific technology for the service implementation. Advantages of the SOA approach are recognized in most studies on middleware solutions for IoT. While a commonly accepted layered architecture is missing, the pro-posed solutions face essentially the same problems of abstracting the devices functionalities and communications capabilities, providing a common set of services and an environment for service composition. It tries to encompass all the functionalities addressed in past works dealing with IoT middleware issues. It is quite similar to the scheme proposed in, which addresses the middleware issues with a complete and integrated architectural approach. It relies on the following layers showed in FIGURE 6. Applications are on the top of this construction. The aim is to export all data or system to the final customer. It is a perfect integration between systems and applications. Services composition is based on SOA structure. It provides functionalities for composition of single services offered by networked objects to build applications. Service management provides the main functions that are available for each object and that allow for their management in the IoT scenario. A service storage is built in this layer which can seek services belong to each object in whole network. Object abstraction is based on many objects such as sensor, monitor, readers, etc. It will transfer all different IT languages to common one and manage them for other procedures. (Magazine Computer Networks 31May 2010, 19)

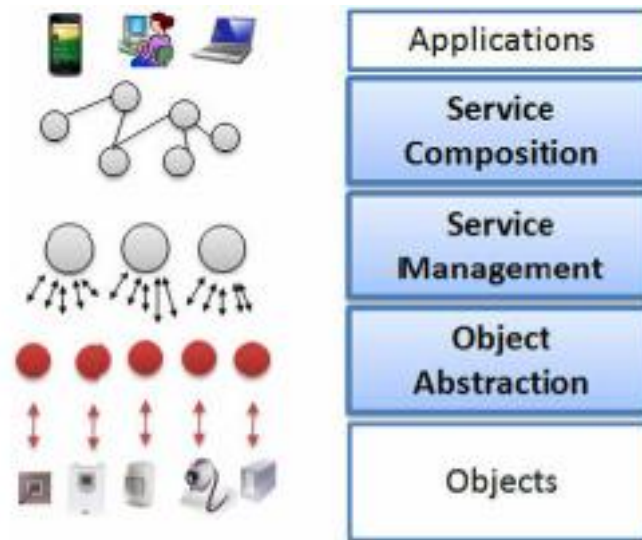


FIGURE 6. SOA structure for IoT middleware

5.1.3 IoT Development situation in China

In 1999, it was the first time to know this name in China. In November, 2008 at a Chinese mobile meeting about innovation development, experts approached mobile technology, Internet of Things which could have a big influence on the whole society.

In 2009, the basic structure of the Internet of Things was formed. And this promotion cooperated with universities and enterprises. With research and applications, the Chinese Internet of Things was developing rapidly in some areas such as Beijing, Shanghai, Zhejiang, and Jiangsu etc.

5.1.4 Applications

The Internet of Things is to the social activities with digital and wide range of applications. The Internet of Things applications include the following areas: the transport and logistics field, the field of health care, intelligent environment (home, office, and factory), personal and social activities. It has a very broad market prospect.

The specific applied fields are shown in FIGURE 7.

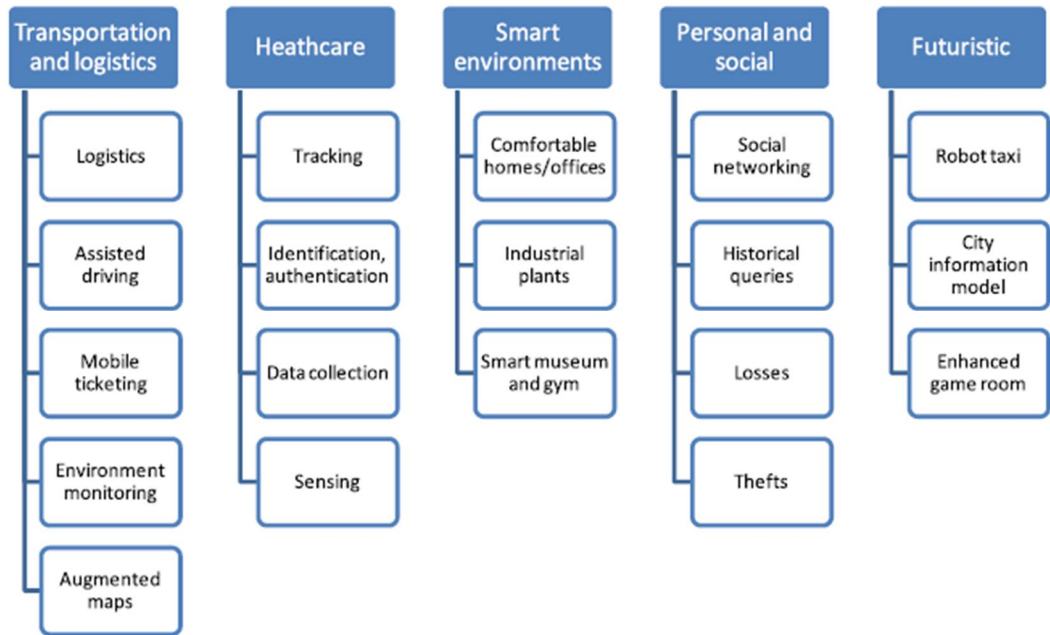


FIGURE 7. Internet of Things applications

5.1.5 Barriers

One major barrier for the widespread adoption of the Internet of Things technology is the absence of governance. Without an authority, similar to the one that is governing Internet, there are high chances that it will be impossible to have a truly global “internet of things”. And also there are limitations with codes and IDs. There are no strong standards and regulations. They are two different, non-compatible ways of identifying objects, and there is the risk to have them competing over the global market.

There is also the need of keeping governance as generic as possible, as having one authority per field will certainly lead to overlap, confusion and competition between standards. EPC Global (The main focus of the group currently is to create both a

worldwide standard for RFID and the use of the Internet to share data via the EPCglobal Network. EPC global's board of governors includes representatives from EPCglobal, GS1, Auto-ID Labs, Cisco Systems, DHL/Exel Supply Chain, Haier Group Company, Johnson & Johnson, Kimberly-Clark Corporation, LG Electronics, Lockheed Martin Corporation, METRO AG, Novartis Pharma AG, Office of the Secretary of Defense, Procter & Gamble, Sony Corporation, The Dow Chemical Company and Wal-Mart Stores, Inc.). Its architecture has a “single point of failure and control” architecture where a single company, VeriSign, has the records of all the numbers, and can track where any object is. As well, objects can have different identities in different contexts so having multiple authorities would create a kind of multi-homing, which can lead to disastrous results.

Furthermore, there is a need to have a technically sound solution to guarantee privacy and the security of the customers in order to have a widespread adoption of any object identification system. While in many cases the security has been done as an add-on feature, it is the feeling that the public acceptance for the internet. (Internet of Things 2020, May, 2008)

5.2 Supply Chain Management (SCM)

5.2.1 Supply chain and SCM definitions

A supply chain is a network of facilities and distribution options that performs the functions of procurement of materials, transformation of these materials into intermediate and finished products, and the distribution of these finished products to customers. Supply chains exist in both service and manufacturing organizations, although the complexity of the chain may vary greatly from industry to industry and firm to firm. (Farooqui 2010,8.)

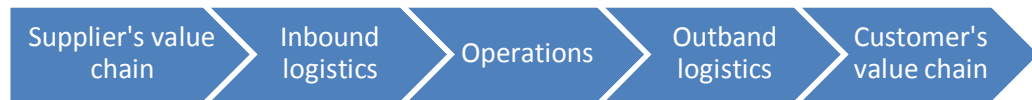


FIGURE 8. The extended value chain (Ferne&Sparks 2009, 15).

The Council of Logistics Management defines SCM as:

The process of planning, implementing and controlling efficient flow of raw materials, in-process inventory, finished goods and related information from point of origin to point of consumption, for the purpose of conforming to customer requirements. Supply chain is a process involving entire business activity. (Bhatnagar 2009, 2.)

5.2.2 Objectives of SCM

There are some objectives of SCM as follows

- a. To provide materials flow with more efficiency and accuracy
- b. To promote inventory management and keep it in a reasonable level with lower costs
- c. To improve suppliers' abilities and find better suppliers
- d. To purchase materials with the lower costs.

5.2.3 SCM benefits

We can get benefits on some aspects by improving SCM as follows

- a. Reduce inventory and promote inventory efficiency and management
- b. Reduce costs
- c. Improve process flow efficiency then keep whole supply chain in a good position in marketing
- d. Improve customers' satisfaction
- e. Improve delivery abilities and reduce lead time
- f. Stronger connections between suppliers and customers.

6 ANALYSIS OF THE CASE STUDY

This chapter analyses the ways to integrate the external and internal concepts in tobacco enterprises. And the most important goal is finding solutions to solve problems in the case study company, the Hangzhou tobacco logistics center. Section 6.1 discusses Internet of Things (IoT) applications for tobacco enterprises. From the beginning to the present development, from the state support to building frameworks in companies, the Internet of Things (IoT) plays a key role in the future tobacco supply chain. Section 6.2 discusses the internal activities in every department in the Hangzhou tobacco logistics center and emphasizes the present situation with the existing problems and the analysis. The last section 6.3 presents solutions and models to the Hangzhou tobacco logistics center with internal and external directions.

6.1 External Integration of the Tobacco Supply Chain

6.1.1 Development plan for the Chinese tobacco IoT

Significance of the Chinese tobacco Internet of Things

To meet the customers' requirements and improve the core competitive power in hard competition, this is a good time to make a plan for developing the Internet of Things in the Chinese tobacco business.

According to the Internet of Things, involving a comprehensive sense, reliable transmission and intelligent processing technologies will make a modern strategic tobacco value chain.

The Chinese tobacco Internet of Things will be used in the Chinese tobacco business. It will rely on sensors, barcode, RFID, multimedia devices. Then, according to intranet, internet and wireless network transmission, sharing and data analysis, it will form an intelligent network for decision-making and process controlling. The intelligent network will include planting, manufacturing, purchasing, sales, delivery, marketing and management. The network will help and promote management areas in manufacturing, quality control, logistics costs, inventory, and supply chains. It has an important influence on the tobacco supply chain optimization, technology promotion and better services.

Current situation of the Chinese tobacco Internet of Things

The Internet of Things with applications and construction in the China tobacco business has been planned and built up earlier if compared with the other business fields. But the scale is not wide due to the differences in the economic situation in different provinces.

In year 2003, China tobacco business built up marketing and controlling management systems (called 1project) for producing tobacco products in order to improve control and management levels. Its aim and core thoughts were to process a flow of printing and scanning barcodes (called 2print-3scan), which would transfer tobacco products' information from the industrial and commercial enterprise into a whole tobacco information platform. By these ways, the Chinese tobacco business had a clear scenario for quantity, inventory and sales of manufactory and marketing. It tracked, monitored and managed tobacco information. Systems improved efficiency in some fields such as tobacco products inventory, shared information with industrial and commercial enterprises with less resources and environmental friendly by using technology such as barcodes, RFID, etc.

At present, tobacco logistics has a significant development with technology and systems. Based on RFID, GPS, GIS, tobacco logistics achieve the goals for getting

information and monitoring products for inventory, sorting and delivery.

During many efforts by state and enterprises, although tobacco modern logistics is developing more and more rapidly and effectively, it still has some problems and shortages.

Firstly, development of tobacco Internet of Things is not in same level if compared with different provinces, where rich provinces has better infrastructures, poor provinces do not. Secondly, development of the tobacco Internet of Things is not in the same level if compared with different types and levels of tobacco involving parties such as industrial and commercial enterprises and wholesalers. For example, a commercial enterprise has a higher level of Internet of Things by using many technologies and a good network, but other two parties still have a lower level of Internet of Things applications. Thus, it could not be formed a closed network connecting all the parties in the tobacco supply chain. Last but not least, there is no standard for the infrastructure of Internet of Things. Each company perhaps has different systems and codes for the same tobacco products. It will take more time and resources to transfer information to common 'languages' applied in the tobacco supply chain.

Thinking to build the tobacco Internet of Things

Building a comprehensive and all-around Internet of Things for the tobacco supply chain is based on using technologies related to Internet of Things such as RFID, multimedia network, wireless network, cloud computing, SOA and other high technologies. It provides advanced and practical services.

To build up an effective and unified process flow with the same standards and regulations is using the present infrastructures and resources of each level from state tobacco associations to the tobacco industrial and commercial enterprises. The aim and target of it will be to form a closed network with sharing information upstream

and downstream.

Building effective regulations and reliable safe technologies is making sure the safety for transmission, storage and using of information. Safe and reliable regulations and technologies will support Internet of Things processing.

There are three steps in developing Chinese tobacco Internet of Things.

1st step: by the end of year 2013, tobacco Internet of Things infrastructure will be finished. The goal is to fulfill tobacco logistics resources sensors and make sure all materials logistics information is under control. Optimizing process flow such as producing, storage in-out, sorting and delivery guarantees work efficiency. And to reduce expenses and improve the safety and qualities is in order to promote the tobacco products' reliability with high efficiency. Based on the above methods, the aim of the first step is to achieve tobacco products process flow to be standardized and optimized.

2nd step: during 4 to 5 years, brief infrastructure of Internet of Things will be built up for industrial tobacco enterprises. Tobacco leaves, baking and producing process in producing tobacco products will be sensed and connected in networks.

3rd step: during 5 to 7 years, the goal is to build a connected, advanced and all-around tobacco Internet of Things. It will be connected with all objects in the tobacco supply chain such as planting, producing, storage, delivery, and marketing. This network will be an automated, shared information and intelligent network for the tobacco supply chain.

By the above three steps, the internet of things for Chinese tobacco business will be greatly improved.

The overall framework for Chinese tobacco internet of things

The frame work contains five aspects. They are discussed follows.

The aim is to build up one control center for data exchange, analysis and storage. There are two levels for this center. One is for the state tobacco association; the other one is for the tobacco marketing of each province. By this way, the control enter will be in a top position which can manage, monitor and control everything in order to forecast and make decisions accurately and easily.

The supporting systems involved are the safety system and the standard system. The safety system supports all information, materials and assets under reliable situation. The standard system involves all barcodes, RFID, data of Internet of Things; it guarantees all information to be monitored and accurate.

Three technologies include sensor, connection and application levels. With all the three technologies cooperating, the tobacco Internet of Things will be formed with comprehensive inspection and upgrading.

Sensing technologies involve object identification, sensor, positioning and video-speech perception. All of these methods will be used for building Internet of Things with clear and comprehensive scenario.

Application fields contain e-business, smart logistics, tracking and inspecting quality and counterfeit, safety and environment monitoring, materials cycling time management and intelligent planting and producing.

E-business and smart logistics firstly offer services for an e-logistics platform and give fresh atmosphere for the sales to customers as well. Thus, customers have experience with tobacco information and status, such as brand, quality and origin. Tracking and inspecting quality and counterfeit checks the situation of every process

in the tobacco supply chain. And if there are some mistakes, it is possible to check which part is wrong as soon as possible. Safety and environment monitoring is necessary for the tobacco business because of tobacco is specific character that needs higher levels of humidity and temperature. Materials cycle time management uses technologies for supporting all the assets and checking the current situation and making forecasts and predictions. Lastly, intelligent planting and processing makes a connection between raw materials and finished products in each procedure.

6.1.2 Building a plan for the Chinese tobacco IoT

Advantages and disadvantages in the current situation

After year 2003, there has been a thought and plan for building up the Chinese tobacco internet of things. Then, with the help of the state and each province is tobacco associations and enterprises, much infrastructure has been started to be built. Some places have shown good performance. But there still are disadvantages. Its usage is not wide in the tobacco supply chain. Moreover, there are big gaps in different provinces' situations.

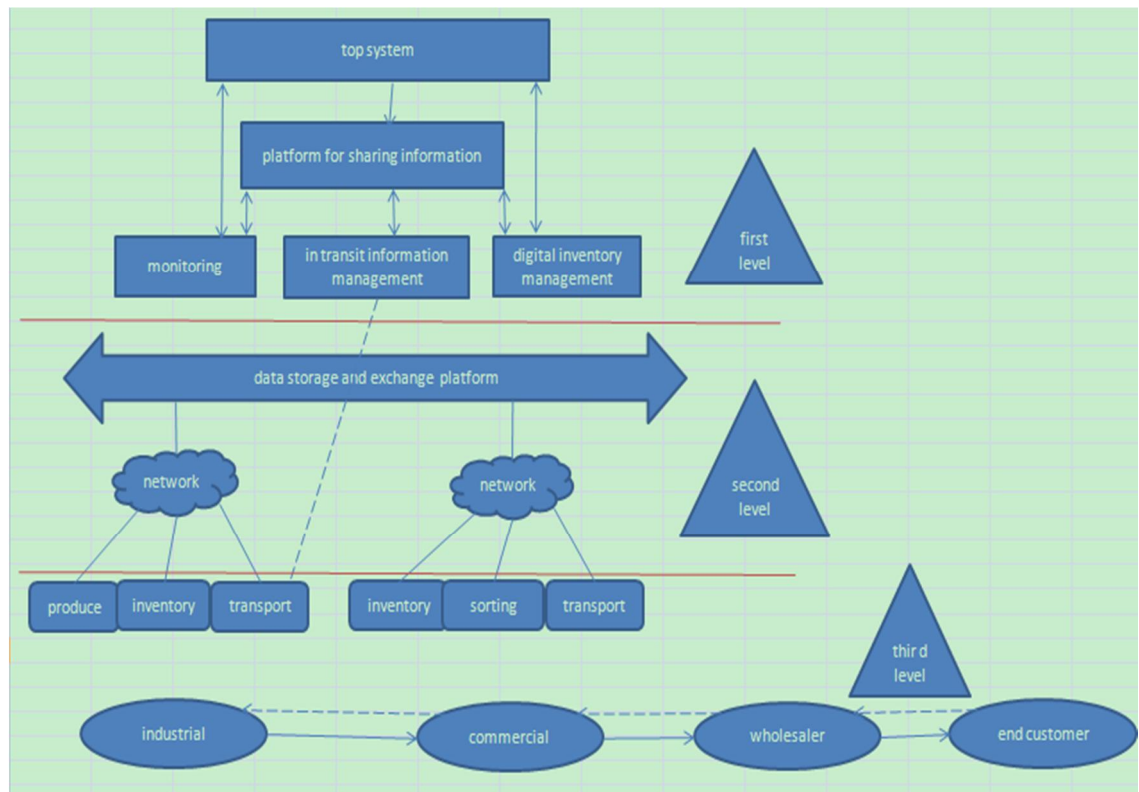


FIGURE 9. Tobacco logistics internet of things structure

Inside, there are three levels shown in FIGURE 9. The current situation of tobacco Internet of Things is improving but still many shortages existed. The first level has not enough ability to connect all parties during tobacco supply chain. On the second level, the network has not been yet for fulfilling the requirements of sharing and monitoring information. Then, it has no entire closed network which can be used for all the parties in tobacco supply chain. On the third level, there is a lack of sensing technologies for accuracy and sharing information.

Tasks and prospects

The task is to integrate all resources in order to share information, effective process flow, and overall control and management for the whole tobacco supply chain. It will combine three fields related to tobacco business, which are agriculture, industrial and commercial enterprises. And it also contains three levels of tobacco business, which are city enterprises, province enterprises and the state.

Fulfilling this framework, the first thing is using technologies such as barcodes, RFID,

sensors, and video monitoring, GPS, GIS to sense all materials, assets and information logistics. By taking into use these methods, this tobacco network will be achieved. Even one piece of tobacco product will be controlled and monitored during all its activities in the tobacco supply chain. The companies will know about all the product's logistics information involving pallets, boxes, delivery vehicles, storage areas, sorting locations and loading-unloading devices. Final customers will also know some related information about tobacco commodities. It can be seen in FIGURE 10.

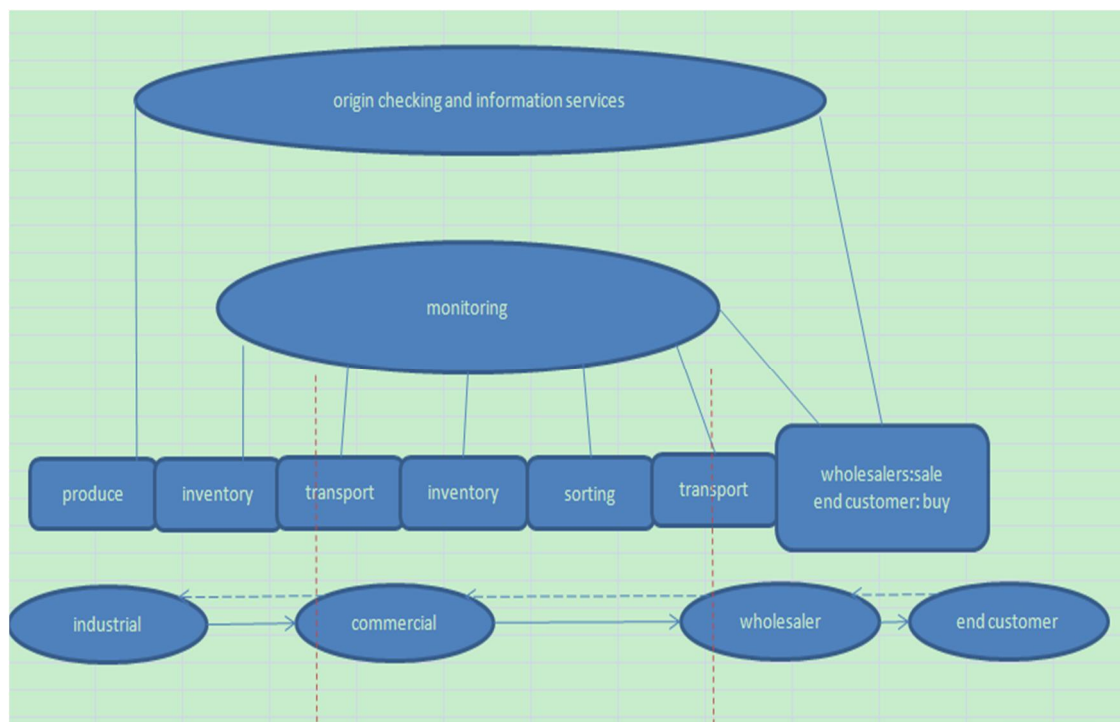


FIGURE 10. Tracking and monitoring by using sensor technologies

The second thing is using network technology, which includes intranet, internet, wireless network and information security system. By combining these technologies, tobacco information everywhere will be recorded and shared by the entire network. And the information security system will support this supply chain's safety and reliability. These will improve efficiency and connect all the parties closed in one circular loop.

The third thing is the integrated logistics flow system, cost management and intelligent dispatching system in order to improve and standardize the tobacco supply

chain.

The core thought in building tobacco internet of things is establishing one top control and managing system for all the processes during the whole supply chain. It will focus on four activities during the tobacco supply chain: tobacco producing, warehousing and inventory, delivery from an industrial enterprise to a commercial enterprise, and sorting. These four main activities determine the next processes such as tracking the origin, optima dispatching, safety monitoring, information services and cost accounting.

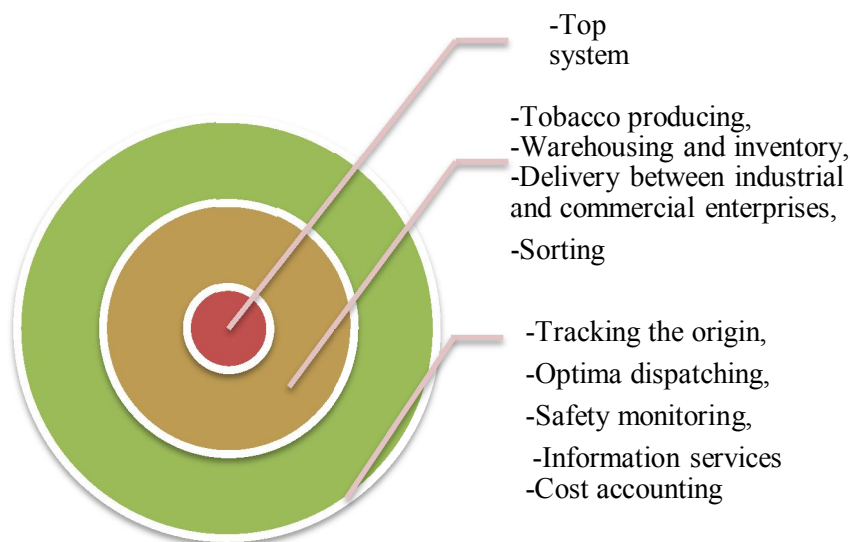


FIGURE 11. Construction route for tobacco Internet of Things

The construction of the Chinese tobacco Internet of Things is based on the top and managing system.

Firstly, barcodes for bar tobacco product and for piece tobacco product are printed by using electronic tags in order to control and monitor the product's situations in each activity. Meanwhile, electronic tags could record something which implies connections between bars and pieces. Secondly, scanning codes should be under monitor and controlled by sensing systems, which ensure reliability during the procedures. Thirdly, consummating information system and services play an important

role in building Internet of Things for tobacco business.

Furthermore, during delivery activities, it should provide information in time and on time for checking whether everything is all right or not. And Internet of Things will connect the warehouse and inventory management and sorting system in order to optimize inventory turnover and storage situations, and sorting time and quantities as well. In the future, when most of the tobacco warehouses are using this kind of system, it will improve efficiency and reduce costs in all the tobacco business in China.

During these years, with technology and information construction development and based on good infrastructure, Internet of Things is coming forth. It will be developed in four fields.

One is building modern logistics. Using current technologies and exploring other technologies, Internet of Things is the one major task for solving and providing solutions for logistics fields.

Two is security protection. Because of the tobacco specific characters, it should pay more attention to tobacco authenticity. Using Internet of Things will gather all information then analysis and alarm prediction if something is wrong.

Three is tobacco quality management. According to thing to thing connections, it will control product quality and track origin for each activity during producing tobacco products and marketing. It will manage product life cycle. And if needed, one product can be checked its origin and situation from upstream to downstream in value chains. By this way, it will improve product's quality and services' satisfaction.

Four is assets management. By using RFID, GIS technologies, it will monitor, control and manage assets positioned, tagged and tracked. During these methods, whole tobacco supply chain will be improved efficiency. Assets will be more standardization.

6.1.3 Tobacco logistics information system applications

It will share information in different fields and different levels in the tobacco supply chain. The information contains analysis reports of tobacco sales forecast, market and brand for all parties in the tobacco chain nationally. Every section will check information and find reports or other paper materials in this information system.

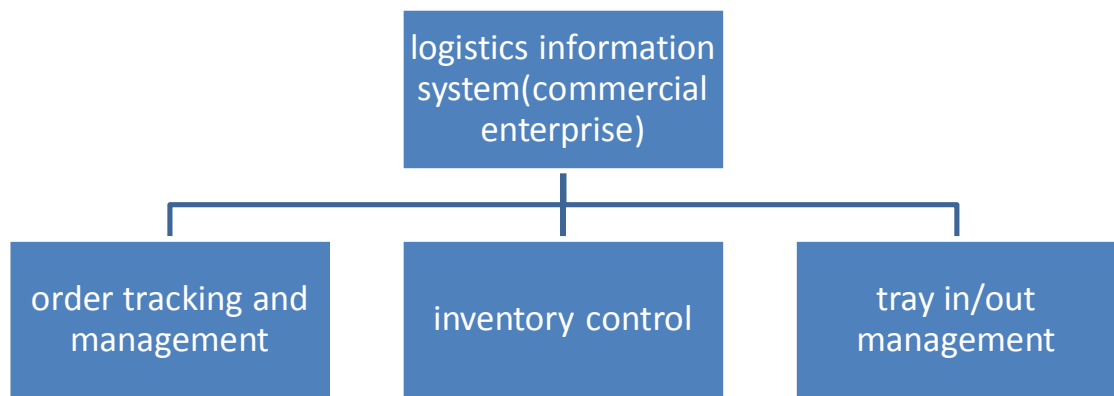


FIGURE 12. Logistics information system connected commercial and industrial enterprises function

Warehouse management system contains core logistics activities in tobacco supply chain. It is in charge of product in-out storage and inventory management. It will be connected with sorting system and delivery system as core activities in the tobacco supply chain. It is shown in FIGURE 13.

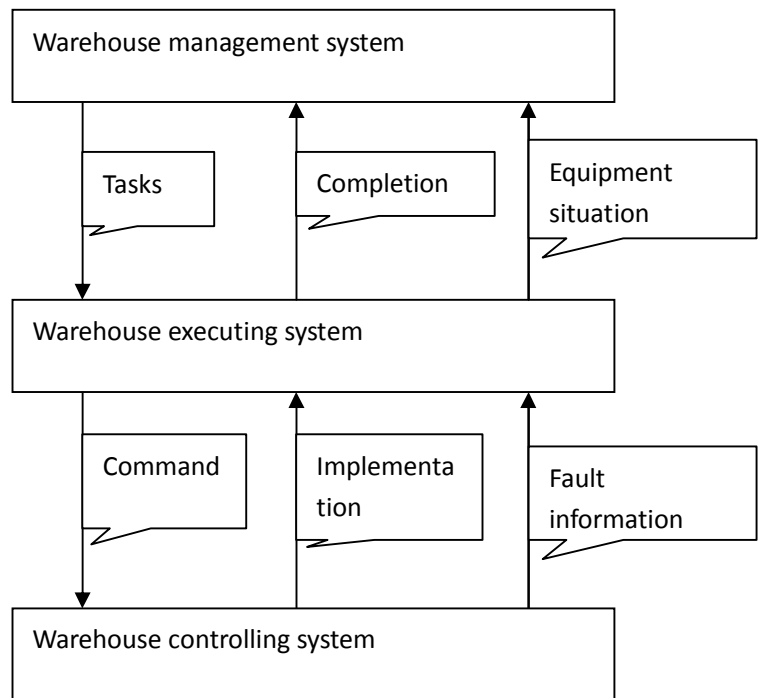


FIGURE 13. Warehouse management system

Sorting management system handles sorting activities. Connected with sorting devices such as automated, half-automated, electronic tags, and manual sorting, etc., it will achieve the goals for sorting tobaccos, print codes to bar piece and automated packaging. By these ways, it will reduce mistakes compared with by manpower and improve sorting efficiency.

Delivery management system contains four parts, which are the transportation management system, route optimization system, vehicle monitoring dispatching system and intelligent distribution navigation system. By these systems combined, the delivery management system will have a critical effect on the whole tobacco supply chain. As we know, in logistics, the biggest part is transportation. It will take big proportions of time and costs. And in these four subsystems, the most important one is the route optimization system. It will decide the products' values and business profits.

Logistics costs management system involves costs management in the tobacco supply chain such as sorting costs, packaging costs, and delivery costs, etc. This system will divide these costs in to smaller parts and analyse them in order to save costs in the

supply chain.

Based on the GIS, GPRS, RFID, INTERNET, and BI technologies, information in transit management system will build an advanced and standard system for connecting producing and marketing tobacco areas. By this way, it will save costs and resources, improve efficiency and provide security for the tobacco chains.

6.2 Internal integration of the departments' work

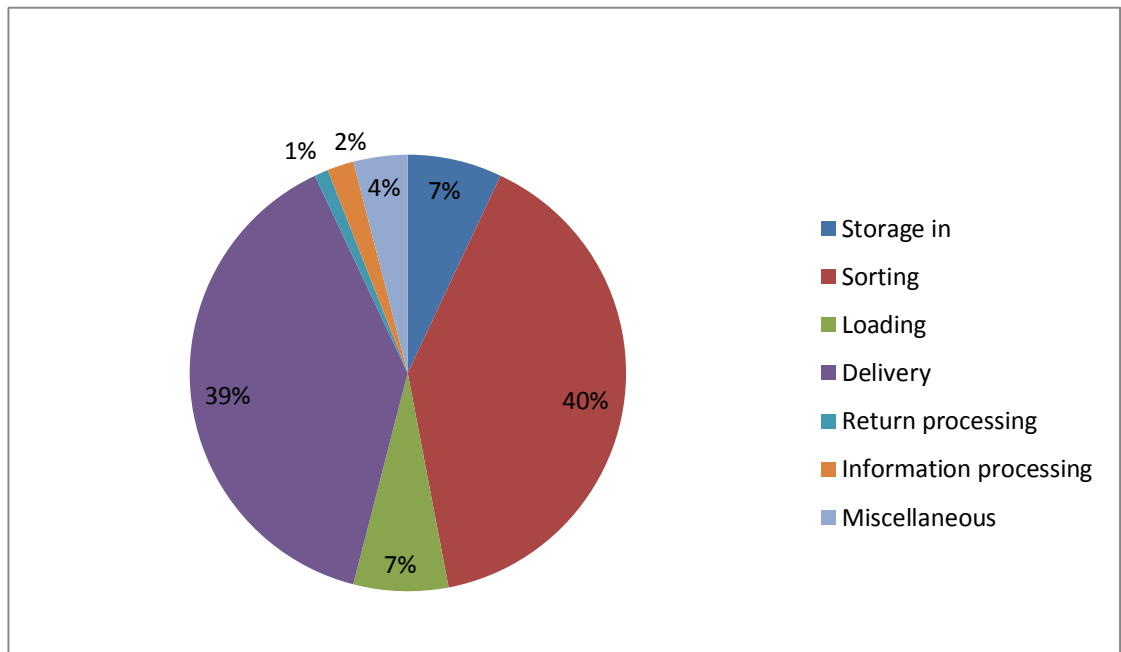


FIGURE 14. Time-scale proportion of operations in logistics center

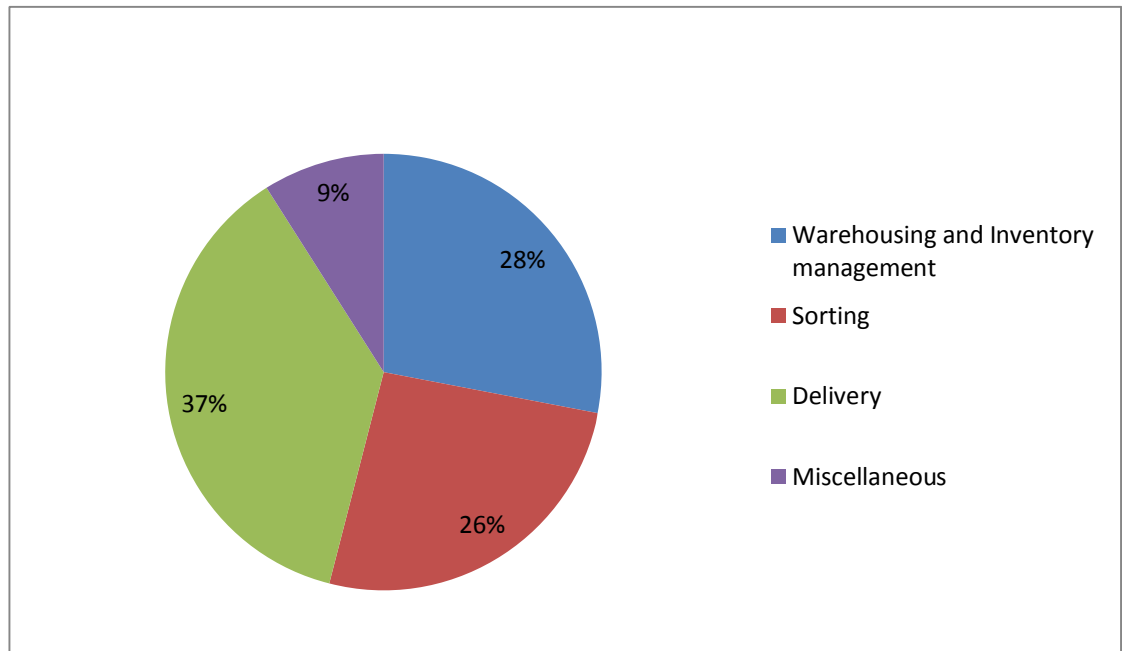


FIGURE 15. Cost-scale proportions of operations in logistics center

From FIGURE 14 and FIGURE 15, we can see clearly that the sorting process plays an important role in logistics activities. Optimization of the process flow is a key point for successful tobacco logistics. During these years, some provinces have taken some steps to improve automation of the sorting system with a lot of money. But considering the input and output ratios, it has to be said that the present sorting situation is not satisfactory.

For delivery and inventory process, the important thing is standardization for the instruments during logistics procedures. But at present, there still have companies use different pallets and instruments for delivery and inventory. It will increase not only costs but also mistakes. Even tobacco values will be decreased by some wrong operations.

In one tobacco commercial enterprise, there are many departments belong to it. Some departments only consider their own works and own performance and benefits for the sake of getting more praise from up-levels. But by this way, it is not good for the tobacco supply chain if seen by wild view. It will cause waste resources and repeated

operations. In a long-term perspective, this company will lose market share and profit even worse to be bankrupt.

6.3 Solutions and Models for the Case Study

6.3.1 Internal problems solutions

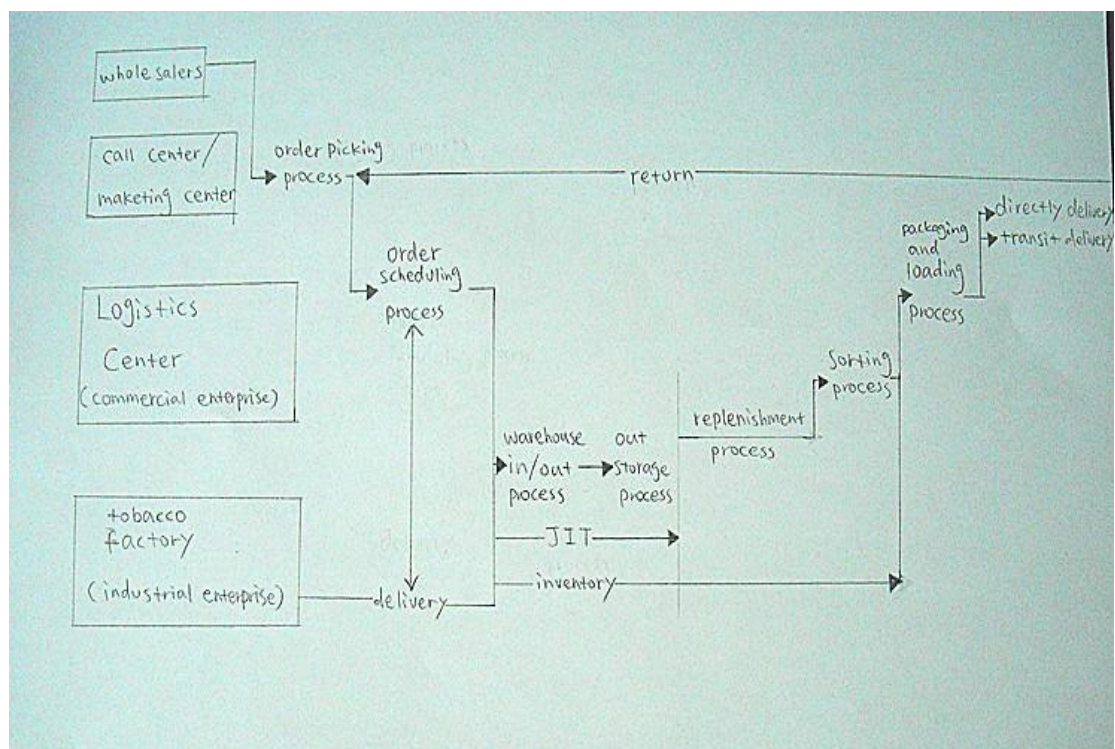


FIGURE 16 . New design for process flow

There is a new design for process flow:

Gathering orders from customers by the call center, then the call center cooperates with logistics center affairs department. Affairs department making orders and commands to reserved department which is doing main operations in warehouse and sorting areas. According to command and order from affairs department, after sorting and loading, then transfer and share information with delivery department. Thus, all of departments will be connected in the network. And during this flow chart seen in

FIGURE 16, it is easier to follow activities step by step. When it happens mistakes, it will check and find where is wrong as soon as possible. On the other hand, it improves efficiency for logistics operations of Hangzhou tobacco logistics center.

Instruments are popular used in logistics work. For the tobacco products, the standardization for packaging and ways of put of quantities, size, and weight are important for delivery and inventory. Then, making standard and establishing common rules and regulations are vital to the logistics activities.

There are some standards for pallets considered their life cycle, price, materials, etc. By analysis of these conditions, shown as FIGURE 17, composite with high density pallets are the best choice for tobacco logistics work.

Comparison of contents	Wood	Metal	Plastic	Paper	Composite with high density
Resistance to chemical corrosion	2	1	4	2	4
Resistance to humidity	1	2	5	1	4
Resistance to Moth-eaten	1	5	5	2	4
Life cycle	1	4	2	1	4
Price	5	3	3	5	4
Comprehensive evaluation	2	3	3	2	4
Grades : 1-5 (1 for bad, 5 for good)					

FIGURE 17. Performance comparison of various materials of pallets

For packaging part, there has strict ways for putting styles in order to make sure the safety and tobacco products without broken in loading-unloading and transportation processes. There is one way with 3 layers in 10 pieces per each.

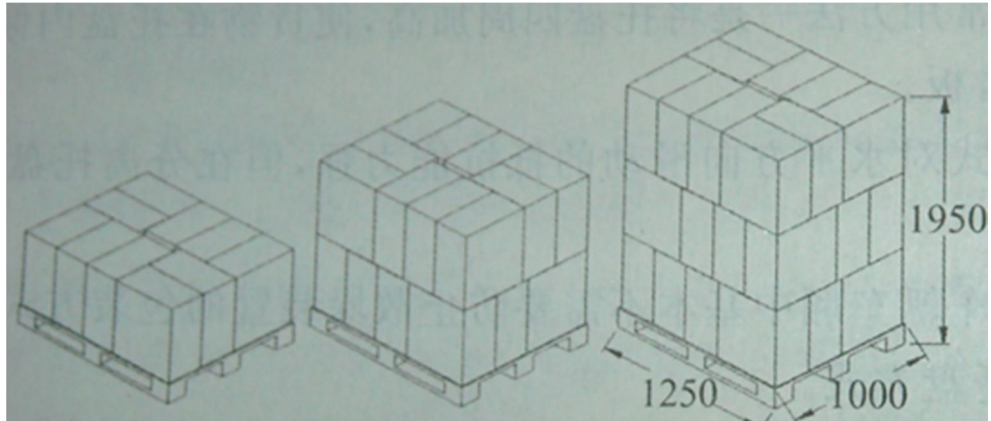


FIGURE 18. Putting samples

There has to be built a logistics information platform contains all activities' situation and information in logistics center. And also it needs combined all parties which within 5 departments and 1 call center together by using this logistics information system. A model designed based on different and continues operations which are charged in different departments. On one hand, it is clear to see work belong to which department. On the other hand, it is clear to see connections of the departments and operations.

6.3.2 External problems solutions

For solving eternal problems, the main idea is building a network connected industrial enterprise, commercial enterprise and wholesalers. During this network, it contains operating system for logistics activities by using technologies related to Internet of Things. The specific schemes are shown in following Figures.

Top system (information handling and controlling system)		
Logistics optima dispatching system	Integrated logistics services management system	
Digital inventory system	Tracking system (orders and product qualities)	Monitoring in transit system

FIGURE 19. Application systems for external integration

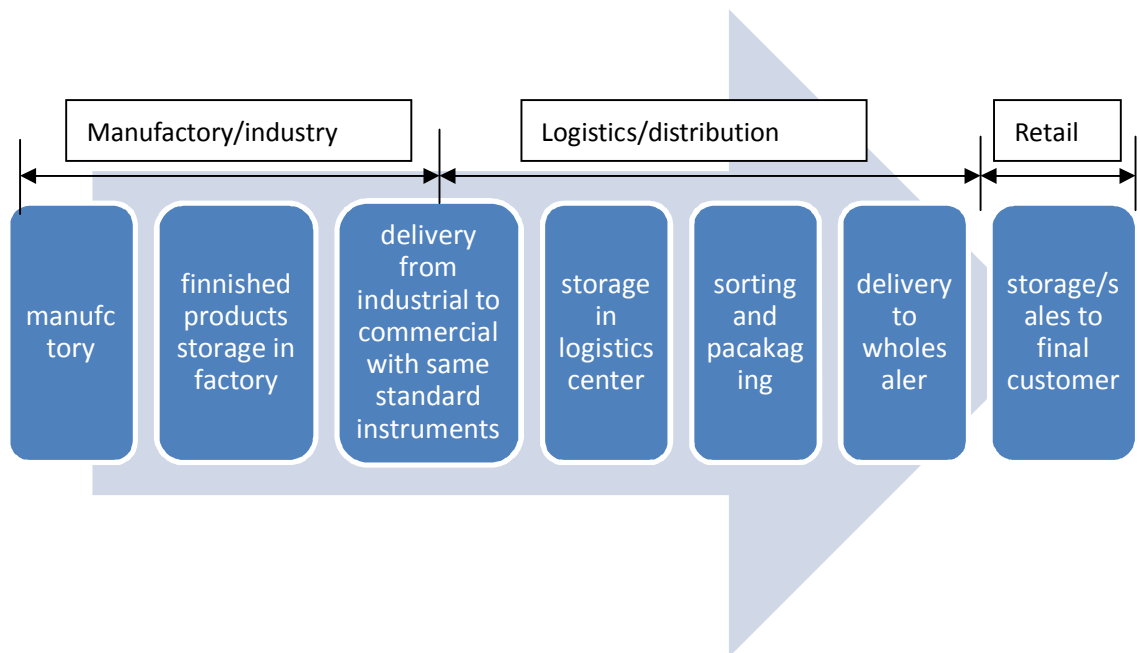


FIGURE 20. Tobacco supply chain

warehousing management

- in-out storage
- inventory
- sorting

order checking

- tobacco codes
- life cycle
- origin

transport in industrail and commercial control

- optimazation for routes
- dispatching
- vehicles and personnel

delivery plan management

- tracking
- alarm
- interactive communication

logistics statistics analysis

- information check
- services consaulting

FIGURE 21. Operating functions in each activity



FIGURE 22. System functions contents

The structure shown in FIGURE 22 is a core strategy for integration to the tobacco enterprises.

First is to consummate top systems for managing and improving logistics activities. Building a clear, effective, JIT, smart information logistics platform for all objects is necessary.

Second is using RFID, GPS, GIS, GPRS and video monitor technologies related to

Internet of Things. It will monitor and control situation in each process. And according to tobacco supply chain network platform, it will provide information and situation for each object involve in whole value chain. Meanwhile, it will save costs and recourses.

Third is digital warehouse monitor system. By using digital monitors, sensors for temperate and humidity and other technologies related to Internet of Things, it will support the tobacco products safety and valuable. On the other hand, it will give information to other activities and situations about inventory and space for storage. Moreover, it will be updated into top management system for next round marketing forecasting. It forms a good environment for warehousing system as well.

Fourth is optimization for dispatching system. By using sensor system and connected with other logistics activities, it will improve process flow, route optimization and inventory management. Thus, it will promote efficiency.

Fifth is tracking system. Tracking tobacco products in manufactory, inventory, transportation and sorting process are using by bar codes, RFID, GPS, and GIS. It will provide information about life cycle and origin. If there has something wrong with the tobacco products, it will be easier to find out which process happened mistakes. During this system, there are two tracking lines. First one is from customer to manufacture, which means from downstream to upstream; the other one is from manufacture to customer, which means from upstream to downstream. These two ways make sure all information are controlled and monitored during tobacco supply chain.

Sixth is integrated logistics management system. The main idea about it is costs. By using Internet of Things, it will improve accurate management. It will provide information for whole logistics activities. Thus, it will help manager to book a plan and find strategies for saving costs. It will manage logistics assets and resources at the top level.

Meanwhile, it has three levels by using network servers. The top level is tobacco business server which manages and controls industrial and commercial activities. The second level is servers for the industrial enterprises and the commercial enterprises which control their independent servers. The third level is the smallest unit in this network which takes in charge of their individual activities.

The system chart is as follows:

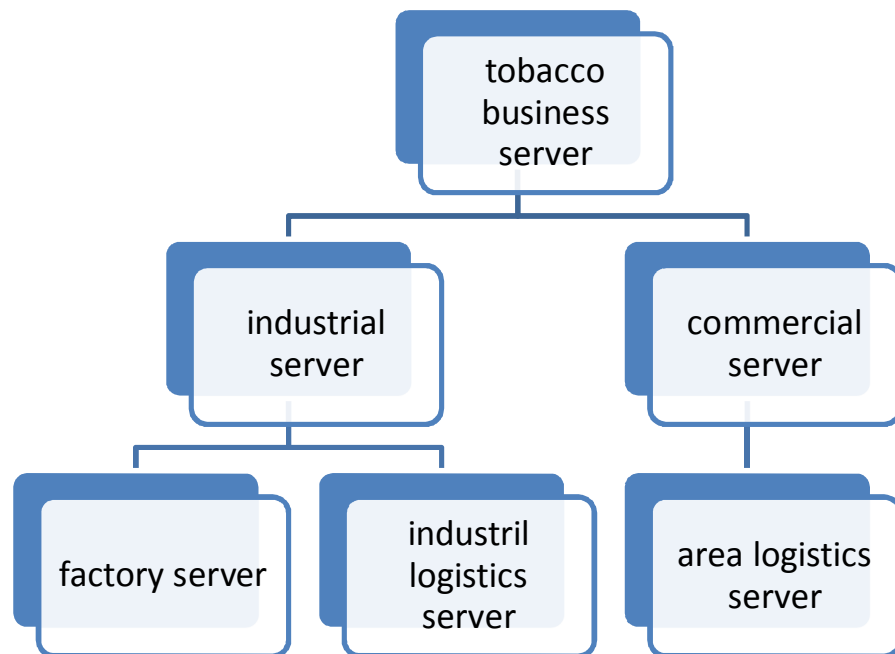


FIGURE 23. Internet of things network system

7. CONCLUSION AND IMPLICATIONS

This chapter presents the conclusions for the case study, implications to tobacco business enterprises, and attention aspects. Section 7.1 summarizes solutions to internal and external problems. Section 7.2 shows the main theories and platform related to the case study. Section 7.3 presents some implications which are focused on enterprises in the tobacco business. And the last section 7.4 recommends future directions and other attention points in practical implications.

7.1 Conclusions

Based on the analysis and finding solutions for the Hangzhou tobacco logistics center, we can see that there exists two kinds of problems. One is external problems; the other one is internal problems. For external problems, the core task is using IoT for the whole tobacco supply chain. And for internal problems, the main idea is to integrate all the departments' work in the logistics center.

7.2 Major Contributions of This Study

This study is an analysis and finding new solutions with information network platform in one special kind of business field. Using the Internet of Things (IoT) and supply chain management in external and internal directions in enterprises provides novel and efficient strategies for business enterprises in the future.

7.3 Implications for Tobacco Companies

For the Chinese tobacco companies, building a network which involves all the objects in the tobacco supply chain is one trend in the future development and innovations. Only sharing information, integrating resources in network and high technologies research and applications, will guarantee a good status in the tobacco business market.

7.4 Recommendations for Future Research

The solutions both to external and internal problems need a lot of things to support them. They need high technologies, a lot of funds, researchers and professional staffs, advanced equipment, the state and business support and a lot of time and energies.

Furthermore, in addition to these many things which can solve these problems, the other necessary part is trust and cooperation with internal and external partners. Without these, all the efforts are in vain. Without these, no one company will achieve the best scores in any type and field business.

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APPENDICES

Appendices present photos of Hangzhou tobacco logistics center taken by Zhao Liubaihe.

Appendix 1. Sorting lines



Appendix 2. Temporary storage areas and loading areas



Appendix 3. Warehousing and inventory areas



Appendix 4. Delivery vehicles

