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LOG950 Logistics

**Present Situation of Delivery Lockers Services and the
Countermeasures of Its Development**

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Preface

With the development of the Internet and e-commerce, the volume of express industry has been rapidly growing, meanwhile the "last mile" problem in the supply chain has become a serious problem, that the express delivery services industry is faced with in China. So new delivery services arose accordingly. This paper focuses on new delivery services, delivery lockers (pick-up points), studying its characteristics, operating process and economic benefits. For services industries, customers' satisfaction degree is a proper evaluation criterion to knowing its present operating effects, that can be measured by analytic hierarchy process. With operating effects and economic operating efficiency evaluation results, we found some problems and proposed corresponding countermeasures.

Summary

Delivery lockers are an express terminal equipment providing parcels picking up services, which is newly emerging in China in recent years. Such services model better meeting the needs of users to pick-up at any convenient time, are welcomed by express companies and users, and provide an effective solution to "last mile" problem in express industry. This new services is designed to save time costs and labor costs in second delivery, and has become a new development trend for express industry. In this paper, we conducted researches on delivery lockers, mainly by AHP and questionnaires method. And we found a considerable number of problems existing in delivery lockers services, which are in investment and customer satisfaction, and proposed the following solutions: i. establishing regulation about delivery lockers providers; ii. improving delivery lockers; iii. cooperating with express companies and reasonably charging; iv. reasonably selecting delivery lockers locations; v. establishing partnership; vi. seriously dealing with customer complaints; and vii. establishing good corporate image. According to the researches above, in terms of delivery lockers development, it should be started with the most affecting factors, service quality and service price.

Delivery lockers is a relatively narrow study object, to make a thorough study is not easy and very complex, which requires researcher of considerable theoretical foundation and rich practical experience. Moreover, as newly emerging for less than 7 years in Nanjing, there are almost no previous studies and available references. Therefore, when we conducted the study, most information was obtained through field investigation, which maybe strong subjective. So in this study, there are many issues that still need to be further explored and researched. When performing the economic benefit analysis of delivery lockers, some calculations are made on basis of hypothesis, so there can be some inaccuracies. With the in-depth research on delivery lockers and continuous improvement of statistical data, such as a more detailed cost-revenue structure, more professional expert insulting, and more overall questionnaire, calculation methods can be further modified. Research on existing situation of delivery lockers in this paper, is mainly with reference to the field investigation and information obtained from the survey, so there is so far to go for study in delivery lockers.

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1.0 Background and research problem

1.1 International background

Delivery activities began much earlier than public perception in the history, the earliest delivery activities can date back to the Ancient Greece, when Ancient Greeks used to deliver the battlefield report by special messengers, which is the widely known story of Marathon. The modern express services originated in the stage of monopoly capitalism of the United States in the early 20th century. In 1907, demand for private delivery service in the U.S. was very large. United Parcel Service (UPS) was established in such background. Because express services are the implementation of door-to-door delivery services, with which packages can be fast, accurately and reliably delivered to the hands of the consignees. Since the beginning of the 1970s, after less than 40 years, they have become one of the important and indispensable service in the service industries to the world economy. The international express giants, FedEx Corp, United Parcel Service (UPS), Deutsche Post DHL Group's DHL (DHL) are not limited to the local region, they have established branches or have joint venture partners in hundreds countries around the world, express services is also continuing to expand with the growing market, and become closer to consumers' demand.

In recent years, the rapid development of e-commerce also contributes to the rapid growth of express business, but the "last mile" problem has become a bottleneck for express services industry. Thus, new delivery services appeared in the public view. Such services are services with mature management technology in some developed countries. There are some self-help express stations set in Japan, which is known that 99.1% of new buildings and 86% of old buildings are equipped with self-help express stations. In addition to receiving and sending the parcels, it also has features of convenient services, such as charging for electric cars, emergency medical equipment, such as pacemaker, and some uncommon tools for the families such as wrench and pliers. In Western countries, such pick-up points are mainly run by the express companies, such as DHL. In the U.S, pick-up points are operated by express companies and Amazon.

Amazon began putting lockers in Seattle, New York state and near Washington, D.C., about a year ago. By adding the lockers, Amazon is addressing the concerns of some urban apartment dwellers that fear they'll miss a delivery or have their items stolen from their doorstep. Amazon's locker program works fairly simply. Customers who ship their item to a locker—typically in 7-Elevens, grocery or chain drugs stores—are emailed a code after a package arrives that unlocks the door holding their merchandise. The lockers can hold only smaller items that weigh less than 10 pounds, such as books, DVDs or electronic devices like iPads. Users have several days to retrieve their merchandise. Users don't pay extra to use the service but the locker program helps Amazon save on certain shipping costs.(Greg Bensinger, 2012)

As a result, UPS, FedEx Corp. and Deutsche Post DHL Group's DHL unit are investing heavily in new systems geared toward getting e-commerce customers to collect their orders anywhere but their homes.(Greg Bensinger, 2012)

FedEx offers a 24-hour locker system called "Ship&Get" in 31 cities in Texas, as well as Memphis, Tenn., situating most lockers outside FedEx stores or Walgreens pharmacies. In August of last year, the U.S. Postal Service installed 17 "Gopost" lockers in New York and Washington as part of a pilot program with DHL, whose "Packstation" lockers are ubiquitous in Germany. The U.S. Postal Service is testing lockers in Plantation, Fla., and plans to install more of them in Orlando, New York and Miami this summer.(Robbie Whelan, 2015)

Self-pickup stations and lockers have been popular for years in Europe; it is very difficult delivery of the population living in densely populated urban centers. DHL started building self-service lockers in Germany in 2001. Since then, the company has installed 2,700 locker banks, mostly in train stations, and opened 12,000 staffed parcel pickup points, including newsstands and small shops.(Robbie Whelan, 2015)

In Post Ltd., a Polish company that designs lockers that open using a code sent to customers by text message recently presented its lockers at a logistics industry conference in Atlanta. The company has installed lockers that, it says, can save online retailers 30% a package on shipping costs in Poland, the Czech Republic, Russia and Ukraine. It recently installed about 1,000 of the lockers in the U.K.(Robbie Whelan, 2015)

1.2 Chinese background

Modern express services in China started from scratch, keep steadily developing, and gradually forms a certain scale. China has become the world's fastest-growing, largest and most potential express services market.

According to the national report of postal management conference held in Beijing in 2015, in 2014, the volume of express business has achieved 14 billion, ranking first in the world. While in 2012, China's express business volume ranks third after the United States, Japan in the world, when the U.S express business volume is 6.4 billion.

This is caused by the rapid spread of the Internet and e-commerce, online shopping has become the new choice of consumers in China, therefore there is a qualitative leap for the express business volume.

Alibaba Group is a Chinese e-commerce company that provides consumer-to-consumer, business-to-consumer and business-to-business sales services via web portals. As a website for online shopping operated by Alibaba Group, Taobao's daily business transaction reached 91.22 billion yuan in Single Day (11th November, which numbers is similar to four single men, now many businesses will discount their goods in this day and it is becoming a officiously-national shopping day for Chinese), increasing by 60% than last year, and the cumulative logistics orders are more than 467 million. As we mentioned above, it is very difficult to deliver parcels door-to-door in densely populated urban centers. Unfortunately, densely populated urban centers are just the main consumers of online shipping. Such a distribution model has caused a great inconvenience to the couriers and the consignees, directly affecting the delivery efficiency. The problem of end distribution has become a very serious problem, which the express services industry in China is faced with.

In recent years, delivery lockers emerged in China, which are self-help delivery lockers functioning with receiving parcels service. It can temporarily store these parcels in the lockers, send information to the consignees via SMS, and so that to provide consignees 24-

hour self-help pickup services. This service model better meets the consignees' needs to pick up their parcels, thus is welcomed by the express companies and consignees. This delivery locker approach is very popular among domestic express companies since its first appearance and is attractive to the express industries. Now there are many domestic delivery lockers manufacturing companies in China. This service has been invested and put into operation in several universities and residential areas in many cities and achieved good operating effects. This new equipment service is designed to save time costs and labor costs of the second delivery, so it has become a new development trend for express industry today in China.

1.3 Research purpose

In recent years, delivery lockers appears as a new development trend for express industry, however, due to the lack of mature management experience and relatively complicated national conditions, these delivery lockers operators are still in an exploratory stage. This paper will take two delivery lockers operators in Nanjing for case studies, which are faced with some challenges encountered in the process of its development. As Nanjing's two largest market shared delivery lockers operators, Nanjing Haoshenghuo and Nanjing Moge have put their delivery lockers into use for several years. But since there are still other delivery lockers operators in this locality and that share this market, it is faced with both internal and external challenges. With our research, we will find out the main problems of the delivery lockers at this present stage and provide corresponding solutions to these problems. Considering the express services development in China, these solutions should not only contribute to the express industry, but also should be integrated with the whole supply chain because express delivery has played a role of the last mile in the supply chain, which will be our final purpose of this paper.

1.4 Research Significance

In recent years, with online shopping becoming more common and popular, retailers have lost its position in the competition with online sellers and parcel delivery services that share the role of the last mile in the supply chain with online sellers. Express delivery services, emerging with the rapid development of China's economy, is increasingly

showing great vitality and potential. But on the other hand, due to the lack of domestic management and technology in the express industry, service satisfaction and delivery efficiency are difficult to improve. The delivery lockers emerge in order to precisely meet higher demand of consumers and to solve problems in the last mile in the supply chain. With the understanding of its existing situations and characteristics, and according to its drawbacks, feasible measures can be put forward for its future development and promotion, which is not only for solving the last mile in the supply chain problem, but also makes contributions to the development of the domestic express delivery services industry in China.

2.0 Theory review

United States International Trade Commission (2004, p.96-99) defines express delivery services as: "(i) the expedited collection, transport and delivery of documents, printed matter, parcels and/or other goods, while tracking the location of, and maintaining control over, such items throughout the supply of the service and (ii) services provided in connection therewith, such as customs facilitation and logistics services." State Post Bureau in China (2007, p.57) also defines express delivery services as a delivery service that is "transporting, and delivering separately packaged parcels to the address or a designated location at promised time and get the parcels signed from recipients."

Both definitions reflect the demand from the senders, which the delivery of goods should be quick and safe, and recently, this demand is becoming higher and higher. Many express businesses have become increasingly unable to meet customers' needs, so it is urgent for express delivery services information management and innovation.

Lyving put forward with his opinion in the article that there are some indicators reflecting the service level of the international express industry. The main indicators are "(i) delivery time, under the same conditions, shorter delivery time, the stronger the company's competitiveness, (ii) clearance capacity, both clearance speed and problem-solving ability in the clearance process are all indicators to measure express companies, (iii) logistics technical services, which refers to a variety of logistics tools, facilities, equipment and other materials that people use in logistics activities, as well as various methods, skills, and operating procedures derived from science and technology development and work experience, and (iv) value-added services, the various extra services provided by express companies, like insurance, packaging, cash on delivery(COD) and other additional services." (Lv, 2009)

Cai ganging pointed out in his article, "that excellent services offered by express enterprises is an important factor affecting the development of the express industry, since modern society requires the maximum possibility of labor division, in the competition with other express enterprises, enterprises are also required to provide the best services and functions. As a driving force, express services constantly improve its service level of Table to Table and door to door delivery service. For example, FedEx founder, Smith founded

the next day delivery to make FedEx establish its market position in the express delivery market. On the other hand, the services function is also showing a diversification, integration trend." (Cai, 2003)

Effective supply chain management (SCM) has become a potentially valuable way of securing competitive advantage and improving organizational performance since competition is no longer between organizations, but among supply chains. A research indicates that higher levels of SCM practice can lead to enhanced competitive advantage and improved organizational performance. Also, competitive advantage can have a direct, positive impact on organizational performance. (Suhong Li, 2006, p.107-124)

2.1 Self-service parcel pickup service

Self-service parcel delivery service is self-service provided by express companies or third parties (who is not a sender or recipient), with parcel pickup function, or parcel sending function, or a combination of both functions.

2.2 Delivery lockers

Delivery lockers are electronic lockers providing self-service parcel pickup services. It is possible to scan, store, monitor, deliver and manage parcels. With its online server, they consist of a self-service parcel pickup system.

Its online server can perform unified management for every parcel in these delivery lockers (such as information of delivery lockers, parcel information and recipient information etc.). After couriers deliver parcels to the designated location, they can simply store them in the delivery lockers, the online server will automatically send a text message to recipients, including the pickup address, pickup code and other information, recipients can pick up their parcels at any convenient time from the delivery lockers. They just need to input the pickup code, and then they can get their parcels. Its operating process is as shown in figure 2-1.

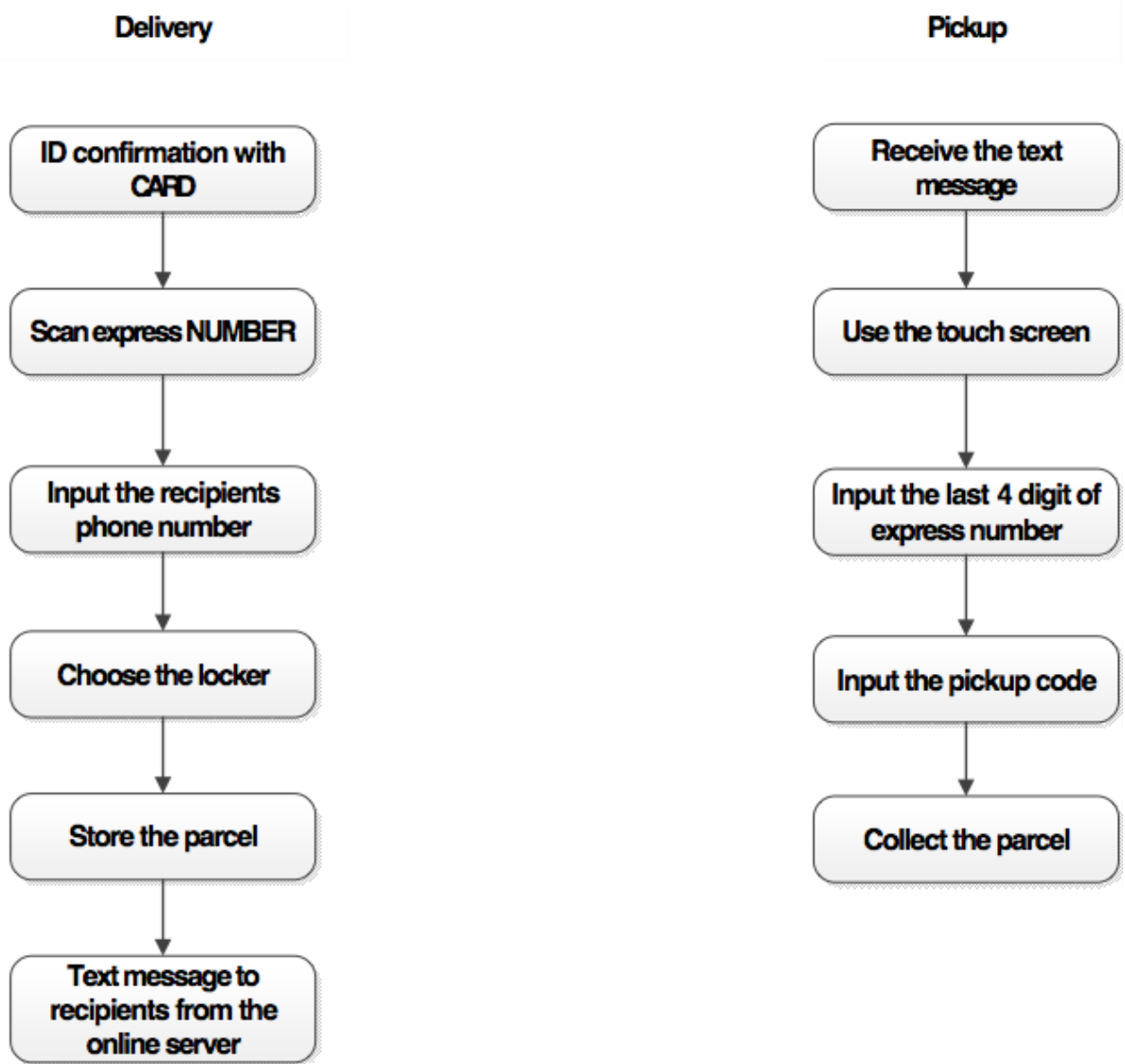


Figure 2-1 Operating process of delivery lockers

3.0 Research Methods

3.1 Read literature

To collect more information about the development and existing situations of delivery lockers in other countries, we have to read relative books and periodicals to know theoretical basis of our research, reports and other documents to learn the existing research results and development experience of delivery lockers in other countries, which will help make analysis of Chinese delivery lockers operating model.

3.2 Field investigation and interview

Field investigation and interview in Nanjing will help to better know and understand the operating model of delivery lockers in Nanjing and thus evaluate existing situations of self-service parcel delivery service in China.

3.3 Questionnaire

Questionnaires survey is conducted to know users and potential users' perception and evaluate for delivery lockers.

3.4 Analytic Hierarchy Process

The analytic hierarchy process (AHP) is a structured technique for organizing and analyzing complex decisions, based on mathematics and psychology. It was developed by Thomas L. Saaty in the 1970s and has been extensively studied and refined since then. (Zhangbingjiang, 2014; Saaty, 1990)

4.0 Operating effects — Delivery lockers customer satisfaction degree evaluation in Nanjing

With introduction and description above, we have known that delivery lockers have achieved some development in China. To better study and analyze delivery lockers development and its problems, Nanjing is selected as the study subject. As delivery lockers providers, Nanjing Moge and Nanjing haoshenghuo will be evaluated and compared by a customer satisfaction degree survey, which will greatly make contributions to our final evaluations and suggestions for the delivery lockers development in China.

4.1 Customer satisfaction degree

Customer satisfaction degree is also called customer satisfaction indicator, and actually, it is considered as a customer satisfaction survey system for the service industries, which is a relative concept. Kotler (2000, p.226) defined satisfaction as: “a person’s feelings of pleasure or disappointment resulting from comparing a product’s perceived performance (or outcome) in relation to his or her expectations”. According to Hansemark and Albinsson (2004, p.40-57), “satisfaction is an overall customer attitude towards a service provider, or an emotional reaction to the difference between what customers anticipate and what they receive, regarding the fulfillment of some need, goal or desire”.

Customer satisfaction degree survey can be used to detect whether what an enterprise or an industry has done meets or exceeds the expectation of its customers. It can identify those key factors, which are directly related to customer satisfaction or dissatisfaction. The enterprise strategies made by this survey, can help fix the corresponding problems and at the same time, it can efficiently save costs and improve economic revenue. With the references to related literature and views of consumers and industry personnel, the following customer satisfaction indicators have been built. We will apply Analytic Hierarchy Process (AHP) method to this survey, which is a weighted multilevel method commonly used in multi-objective evaluation system in systems engineering.(Wang, 2013, p.125-134)

4.2 Analytic Hierarchy Process

Analytic Hierarchy Process (AHP) was developed by Thomas L. Saaty in the 1970s and has been extensively studied and refined since then. It is a combination of qualitative and quantitative method, and is a systematic and hierarchical analytical method.

(Zhangbingjiang, 2014; Saaty, 1990)

Analytic Hierarchy Process procedure is shown as follows.

(1) Establish the hierarchy model

When analytic hierarchy process is used to analyze and solve problems, we must first analyze the relationships between these factors relevant to the problems, and make them organized and hierarchical, and then model the problem as a hierarchy. In this model, the hierarchy structure can be divided into three levels, and a typical hierarchy model is as shown in figure 4-1.

1) The first level

It is the highest level, which is also known as goal level. This level has only one element, and this is a predetermined goal or result to be achieved.

2) The second level

It is the middle level, and is also called criteria level, which can be further divided into sub-criteria and sub-subcriteria. These criteria are involved in achieving the final goal.

3) The third level

It is the bottom level, and is also called alternative level. Elements in this level are various measures, decisions or plans to achieve the goal.

(2) Build judgement matrix

a_{ij} represents the ratio between effects of A_i and A_j on N , and these ratios consist of the matrix $A=(a_{ij})$. A is the judgement matrix for N - A , which is shown as figure 4-2.

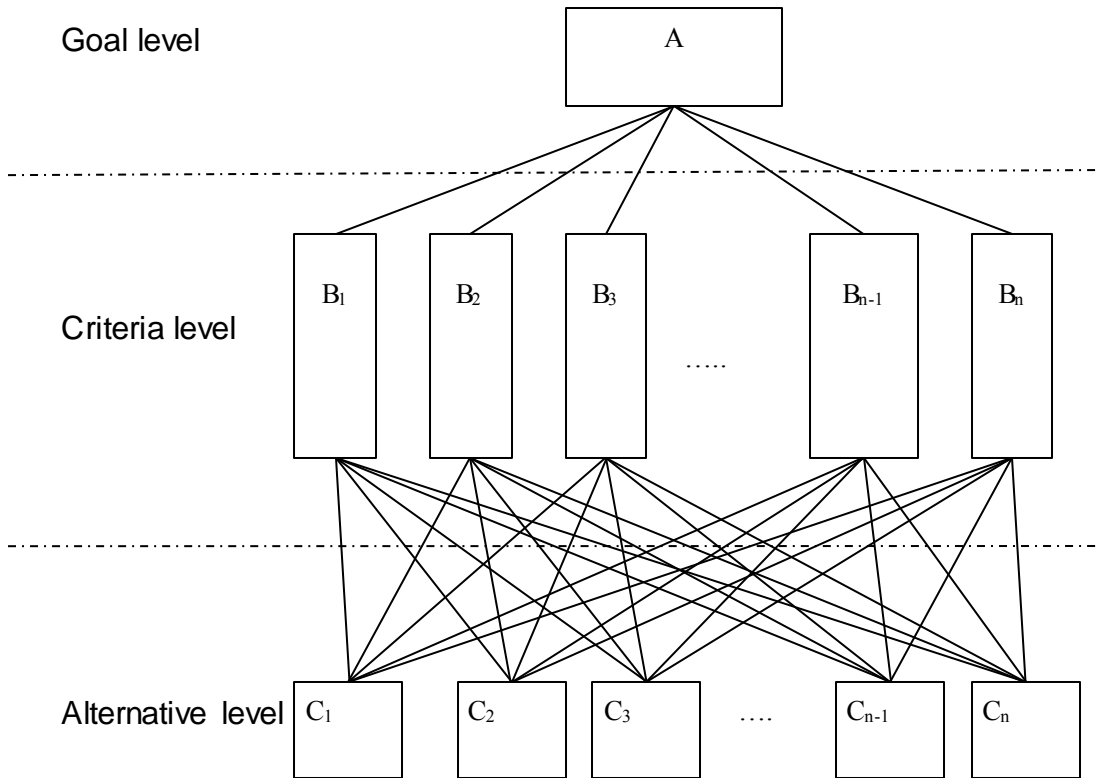


Figure 4-1 Typical hierarchy model

There are:

$$a_{ij} > 0 \quad (4.1)$$

$$a_{ij} = 1/a_{ji} \quad (4.2)$$

$$a_{ij} = 1 \quad (4.3)$$

$$\begin{array}{c}
 A_1 \\
 A_2 \\
 A_3 \\
 \dots \\
 A_n
 \end{array}
 \begin{bmatrix}
 A_1 & A_2 & A_3 & A_4 & \dots & A_n \\
 a_{11} & a_{12} & a_{13} & a_{14} & \dots & a_{1n} \\
 a_{21} & a_{22} & a_{23} & a_{24} & \dots & a_{2n} \\
 a_{31} & a_{32} & a_{33} & a_{34} & \dots & a_{3n} \\
 \dots & \dots & \dots & \dots & \dots & \dots \\
 a_{n1} & a_{n2} & a_{n3} & a_{n4} & \dots & a_{nn}
 \end{bmatrix}$$

Figure 4-2 Judgement matrix

Matrix A with the characteristics (4.1)(4.2)(4.3) is called positive reciprocal matrix.

Obviously, for n-by-n judgement matrix, we just need to judge on its $n(n-1)/2$ elements, in lower triangular or upper triangular.

Values in judgement matrix represent the relative importance degree between each pair in criteria level and alternative level, and they are measured by 1 to 9, which are shown in Table 4-3.

Importance degree indicator	Implication
1	Compared with A_i and A_j , they have equal importance
3	Compared with A_i and A_j , A_i has weak importance
5	Compared with A_i and A_j , A_i has essential importance
7	Compared with A_i and A_j , A_i has very strong importance
9	Compared with A_i and A_j , A_i has absolute importance
2,4,6,8	Intermediate values between numbers above
Reciprocal	If a_{ij} is importance degree ratio between A_i and A_j , then importance degree ratio between A_j and A_i is $a_{ji}=1/a_{ij}$

Table 4-3 Importance degree indicator and its implication

(3) Calculate relative weights and make consistency test

Calculate maximum eigenvalue λ_{\max} and its eigenvector ω_i in each judgement matrix and make consistency test with consistency indicator and consistency ratio. If consistency test have successfully done, eigenvector is the weight vector. If not, we need to restructure a new judgement matrix. When $CR < 0.1$, consistency test is successful.

Consistency test are made by several steps.

1) Calculate maximum eigenvalue λ_{\max} in judgement matrix.

$$\lambda_{\max} = \sum_{i=1}^n \frac{(AW)_i}{nw_i} \quad (4.4)$$

2) Calculate consistency indicator.

$$CI = \frac{\lambda_{\max} - n}{n - 1} \quad (4.5)$$

3) Calculate consistency ratio.

$$CR = \frac{CI}{RI} \quad (4.6)$$

RI (Random Index) is shown in Table 4-4.

Matrix dimension	1	2	3	4	5	6	7	8	9
RI	0	0	0.52	0.89	1.12	0.26	1.36	1.41	1.49

Table 4-4 RI Value

(4) Choose solution

Through consistency test, we can identify the data's validity, and then determine the alternatives ranking in indicator system and weight of each criterion, from which, we can visually see their influences, and accordingly determine or select the appropriate solution.

4.3 Assessment indicator system for delivery lockers customer satisfaction

4.3.1 Company introduction

We chose two companies, Nanjing Moge and Nanjing haoshenghuo, which have relatively larger market share in delivery lockers market in Nanjing. Nanjing haoshenghuo is the first delivery lockers provider in Nanjing, with the largest market share. It has set 510 delivery

lockers in 230 locations in Nanjing. While Nanjing Moge is just a newly-developing delivery lockers provider, but its delivery lockers has a better design and more functions, which makes it the most advanced delivery lockers provider in Nanjing. Therefore it has set 314 delivery lockers in 67 locations in Nanjing.

4.3.1.1 Nanjing Moge company

Nanjing Moge was established in 2012, and it is located in 1865 National Creative Industry Park in Nanjing. It has extended its business to major cities in Jiangsu, Zhenjiang, Shanghai, and Shandong Province. The company teams are mainly from top universities in Nanjing.

Their main products are community intelligent terminals, intelligent logistics terminals, and mobile Internet hardware and software systems. Their main business is to provide third-party service platform for residential areas, office buildings, and college towns, to meet the needs of express delivery industry. Moge makes full use of its software research and development advantages, and its 24 hours delivery lockers can provide many functions, such as self-service parcel delivery services which charges from both couriers and recipients, and water, electricity, and cellphone fee payment functions.

4.3.1.2 Nanjing haoshenghuo company

Nanjing haoshenghuo was established in 2010 by a number of senior managers in traditional industries and financial field, and it aims to improve the community management with intelligent technology and Internet technology, to become the leading Internet service provider in China's community.

Delivery lockers from haoshenghuo also provide self-service parcel delivery services, but it only charges from couriers. Their delivery lockers are close to residential areas with lower logistics costs, and ultimately provide inexpensive high-quality services.

4.3.2 Establishment of assessment indicator system for delivery lockers customer satisfaction

According to the characteristics of delivery lockers, literature research, field research and advices from industry personnel, factors affecting customer satisfaction are divided into five major criterion, which are corporate image, service quality, service price, customer complaints, customer loyalty. And these are shown in Table 4-5.

Goal level	First class/ Criteria level	Second class/ Sub-criteria level	Indicators/ Alternative level	
Customer satisfaction A	Corporate Image B ₁	Public image	Public image C ₁	
		Asset	Advanced equipment C ₂	
	Service quality B ₂	Service reliability		Information accuracy D ₁
				Delivery delay rate D ₂
				Parcel damage rate D ₃
				Tracking ability D ₄
		Service integrity		Personalized service D ₅
				Value-added service D ₆
				Ability to handle disaster and accidents D ₇
	Professional staff		Response D ₈	
			Education D ₉	
	Service Price B ₃	Price rationality		Price acceptance E ₁
				Price satisfaction E ₂
		Competitive price		Rivals competition E ₃
	Customer complaints B ₄	Satisfaction for complaint handling		Satisfaction for complaint handling process F ₁
			Satisfaction for complaint handling time F ₂	
			Satisfaction for complaint handling results F ₃	
Customer loyalty B ₅	Present customer loyalty		Reuse possibility G ₁	
			Recommendation possibility G ₂	
	Long-run customer loyalty		Long-run use possibility G ₃	

Table 4-5 Assessment indicator system for delivery lockers customer satisfaction

- (1) Corporate image: public image and asset. Asset refers to advanced equipment and facilities. Public image refers to how the public recognize about this company and its products or services.
- (2) Service quality: service reliability, service integrity, and professional staff. Service reliability refers to information accuracy, delivery delay rate, parcel damage rate and tracking ability. Professional staff refers to their response to emergency and education.
- (3) Service price: price rationality and competitive price. Price rationality includes price acceptance and price satisfaction. And competitive price refers to rivals competition.
- (4) Customer complaints: satisfaction for complaint handling, which are satisfaction for complaint handling process, satisfaction for complaint handling time and satisfaction for complaint handling results.
- (5) Customer Loyalty: present customer loyalty and long-run customer loyalty. Present customer loyalty includes reuse possibility and recommendation possibility. Long-run customer loyalty means long-run use possibility.

4.3.3 Indicator weight

Indicator weight is relative importance degree of indicators for the overall goal in assessment system. The indicator weight system is divided into three levels, and indicator weight in each level is finally determined by the indicator weight in its lower level. The most commonly used method to identify indicator weights is expert survey method (Delphi method), direct scoring method, functional scoring method, binomial coefficient method and AHP method.(Harold, 1975)

4.3.3.1 Evaluation criterion and judgment matrix

In this paper, the analytic hierarchy process is used to determine the indicator weight. According to a questionnaire for customers and interview for company managers

(Appendix 2), and relevant research data, after reasonable calculation and analysis, indicator weight in each level is shown in Table 4-6 to Table 4-11. Its principle is shown in Table 4-2.

A	B1	B2	B3	B4	B5
B1	1	1/9	1/7	1/3	1/5
B2	9	1	2	4	3
B3	7	1/2	1	3	2
B4	3	1/4	1/3	1	2
B5	5	1/3	1/2	1/2	1

Table 4-6 Customer satisfaction A judgment matrix (A-B)

B1	C1	C2
C1	1	4/9
C2	2 1/4	1

Table 4-7 Corporate image B₁ judgment matrix (B₁-C)

B ₂	D1	D2	D3	D4	D5	D6	D7	D8	D9
D1	1	4/9	1/2	4/5	2/3	4/7	4	4/5	2
D2	2 1/4	1	2	3	3	2	9	2	4
D3	2	1/2	1	2	3	2	9	2	5
D4	1 1/4	1/3	1/2	1	1	1	6	2	3
D5	1 1/2	1/3	1/3	1	1	2	7	2	4
D6	1 3/4	1/2	1/2	1	1/2	1	7	2	4
D7	1/4	1/9	1/9	1/6	1/7	1/7	1	1/3	3/5
D8	1 1/4	1/2	1/2	1/2	1/2	1/2	3	1	3
D9	1/2	1/4	1/5	1/3	1/4	1/4	1 2/3	1/3	1

Table 4-8 Service quality B₂ judgment matrix (B₂-D)

B ₃	E ₁	E ₂	E ₃
E ₁	1	5/7	5/9
E ₂	1 2/5	1	1/2
E ₃	1 4/5	2	1

Table 4-9 Service price B₃ judgment matrix (B₃-E)

B ₄	F ₁	F ₂	F ₃
F ₁	1	2/5	2/9
F ₂	2 1/2	1	2/3
F ₃	4 1/2	1 1/2	1

Table 4-10 Customer complaints B₄ judgment matrix (B₄-F)

B ₅	G ₁	G ₂	G ₃
G ₁	1	5/7	5/9
G ₂	1 2/5	1	1/2
G ₃	1 4/5	2	1

Table 4-11 Customer loyalty B₅ judgment matrix (B₅-G)

4.3.3.2 Consistency test

To avoid errors due to individual subjectivity and one-sidedness during the scoring process, there should be a consistency test for judgement matrix. If it fails in the consistency test, we need to rescore the judgement matrix to construct a new judgement matrix until it passes the consistency test. The results of consistency test are shown in Table 4-12. Its principle is shown in 4-2.

Judgement matrix	λ_{max}	CR
Customer satisfaction A	0.19	0.04
Corporate Image B ₁ (B ₁ -C)	0.00	0.00
Service quality B ₂ (B ₂ -D)	0.32	0.03
Service Price B ₃ (B ₃ -E)	0.00	0.00
Customer complaints B ₄ (B ₄ -F)	0.00	0.00
Customer loyalty B ₅ (B ₅ -G)	0.02	0.02

Table 4-12 Consistency test results for judgement matrix

As we can see in the Table, there is $CR < 0.1$, our judgment matrix has passed the consistency test, so the judgement matrix has satisfactory consistency. That means our scoring and judgment matrix is reasonable, and the indicator weight is also worthy. So in the next step, we can do final calculation and analysis of weights and customer satisfaction.

4.3.4 Calculation of indicator weight in each level

After the consistency test, indicator weight in each level should be calculated. Indicators in each level have been shown in 4.3.3.1, and then we will calculate with those Tables.

The formula is:

$$W_n = T_n / T \quad (4.7)$$

Where $T_n = \sum a_{in} (i=1, 2, \dots, n)$, $T = \sum T_n (i=1, 2, \dots, n)$.

Customer satisfaction	Corporate Image B ₁	Service quality B ₂	Service Price B ₃	Customer complaints B ₄	Customer loyalty B ₅	T _n	W _n =T _n /T T=48.20
Corporate Image B ₁	1	1/9	1/7	1/3	1/5	1.79	0.04
Service quality B ₂	9	1	2	4	3	19.00	0.39
Service Price B ₃	7	1/2	1	3	2	13.50	0.28
Customer complaints B ₄	3	1/4	1/3	1	2	6.58	0.14
Customer loyalty B ₅	5	1/3	1/2	1/2	1	7.33	0.15

Table 4-13 Indicator weights in second level (A-B)

Corporate image	Advanced equipment C ₂	Public image C ₁	T _n	W _n =T _n /T T=4.69
Advanced equipment C ₂	1	4/9	1.44	0.31
Public image C ₁	2 1/4	1	3.25	0.69

Table 4-14 Indicator weights in third level (B₁-C)

Service quality	Information accuracy D ₁	Delivery delay rate D ₂	Parcel damage rate D ₃	Tracking ability D ₄	Personalized service D ₅	Value-added service D ₆	Ability to handle disaster and accidents D ₇	Response D ₈	Education D ₉	T _n	$W_n = T_n/T$ T=137.42
Information accuracy D ₁	1	4/9	1/2	4/5	2/3	4/7	4	4/5	2	10.8	0.08
Delivery delay rate D ₂	2 1/4	1	2	3	3	2	9	2	4	28.3	0.21
Parcel damage rate D ₃	2	1/2	1	2	3	2	9	2	5	26.5	0.19
Tracking ability D ₄	1 1/4	1/3	1/2	1	1	1	6	2	3	16.1	0.12
Personalized service D ₅	1 1/2	1/3	1/3	1	1	2	7	2	4	19.2	0.14
Value-added service D ₆	1 3/4	1/2	1/2	1	1/2	1	7	2	4	18.3	0.13
Ability to handle disaster and accidents D ₇	1/4	1/9	1/9	1/6	1/7	1/7	1	1/3	3/5	2.9	0.02
Response D ₈	1 1/4	1/2	1/2	1/2	1/2	1/2	3	1	3	10.8	0.08
Education D ₉	1/2	1/4	1/5	1/3	1/4	1/4	1 2/3	1/3	1	4.8	0.03

Table 4-15 Indicator weights in third level (B₂-D)

Service price	Price acceptance E ₁	Price satisfaction E ₂	Rivals competition E ₃	T _n	$W_n = T_n/T$ T=9.97
Price acceptance E ₁	1	5/7	5/9	2.27	0.23
Price satisfaction E ₂	1 2/5	1	1/2	2.90	0.29
Rivals competition E ₃	1 4/5	2	1	4.80	0.48

Table 4-16 Indicator weights in third level (B₃-E)

Customer complaints	Satisfaction for complaint handling process F ₁	Satisfaction for complaint handling time F ₂	Satisfaction for complaint handling results F ₃	T _n	W _n =T _n /T T=12.79
Satisfaction for complaint handling process F ₁	1	2/5	2/9	1.62	0.13
Satisfaction for complaint handling time F ₂	2 1/2	1	2/3	4.17	0.33
Satisfaction for complaint handling results F ₃	4 1/2	1 1/2	1	7.00	0.55

Table 4-17 Indicator weights in third level (B₄-F)

Customer loyalty	Reuse possibility G ₁	Recommendation possibility G ₂	Long-run use possibility G ₃	T _n	W _n =T _n /T T=10.52
Reuse possibility G ₁	1	4/7	4/9	2.02	0.19
Recommendation possibility G ₂	1 3/4	1	1/2	3.25	0.31
Long-run use possibility G ₃	2 1/4	2	1	5.25	0.50

Table 4-18 Indicator weights in third level (B₅-G)

First class	Indicator weights in second level W_n	Indicators	Indicator weights in third level W_n'	Relative indicator weight $W_n'' = W_n \times W_n'$
Corporate Image B ₁	0.04	Public image C ₁	0.31	0.01
		Advanced equipment C ₂	0.69	0.03
Service quality B ₂	0.39	Information accuracy D ₁	0.08	0.03
		Delivery delay rate D ₂	0.21	0.08
		Parcel damage rate D ₃	0.19	0.07
		Tracking ability D ₄	0.12	0.05
		Personalized service D ₅	0.14	0.05
		Value-added service D ₆	0.13	0.05
		Ability to handle disaster and accidents D ₇	0.02	0.01
		Response D ₈	0.08	0.03
		Education D ₉	0.03	0.01
Service Price B ₃	0.28	Price acceptance E ₁	0.23	0.06
		Price satisfaction E ₂	0.29	0.08
		Rivals competition E ₃	0.28	0.08
Customer complaints B ₄	0.14	Satisfaction for complaint handling process F ₁	0.13	0.02
		Satisfaction for complaint handling time F ₂	0.33	0.05
		Satisfaction for complaint handling results F ₃	0.55	0.08
Customer loyalty B ₅	0.15	Reuse possibility G ₁	0.19	0.03
		Recommendation possibility G ₂	0.31	0.05
		Long-run use possibility G ₃	0.50	0.08

Table 4-19 Indicator weights for evaluation system

According to Table 4-13 to Table 4-19 above, we can get the final indicator weights for evaluation system. And with indicator weights we have calculated in Tabled above, we can calculate the relative indicator weight.

4.4 Customer Satisfaction Degree Survey

4.4.1 Survey Design

(1) Survey Objective

1) This survey is aimed to learn the strengths and weaknesses of delivery lockers in terms of customer satisfaction, to better know customers' needs in this market, and finally to help provide customers with more comprehensive and high quality service, and establish a better corporate image.

2) The questionnaire analysis will assist understanding customer needs, according to which, delivery lockers can be functionally improved in details. This will be helpful to improve customer satisfaction and explore its business model, and to seek maximum revenue with limited resources.

(2) Survey content

This survey is about the customer satisfaction degree of delivery lockers from Nanjing Moge company and Nanjing haoshenghuo company. As mentioned above, the survey consists of five criterion, corporate image, service price, service quality, customer complaints, and customer loyalty, and their 20 affecting factors.

(3) Survey respondents

Survey respondents are 400 customers from Nanjing Moge company, in which 394 customers responded to our survey, and Nanjing Haoshenghuo company and also people who haven't used delivery lockers.

(4) Survey methods

1) Expert consultation method

According to our survey content, we consult the delivery lockers company, express delivery industry managers and their consumers to help determine the evaluation indicator and indicator weight.

2) Questionnaire method

By field investigation, in order to obtain first-hand and accurate data, we collected data through questionnaires.

3) Interview

In order to collect data about customer complaints, we interviewed with customers who have made complaints by telephone. And to get more detailed data about these two companies, we also interviewed their managers, and got relevant data involved in this evaluation system, such as delivery delay rate and parcel damage rate.

4.4.2 Questionnaire and data collection

4.4.2.1 Questionnaire distribution

All respondents in this survey are from residential areas, office buildings in Xiaguanqu and Gulouqu, and from college towns in Pukouqu and Jiangniang. And our survey was conducted from 17th Jan to 25 Jan in 2016, in the period of 9 days. In order to ensure the randomness, authenticity and validity of the questionnaire, we have some arrangements during the questionnaire distribution:

Firstly, time period selection. We distributed the questionnaires in weekends and weekdays and in morning, noon, afternoon for each day to make sure that time period won't be an interference factor.

Secondly, respondents selection. In this survey, respondents are working, studying or living in the areas equipped with delivery lockers from Nanjing Moge and Nanjing

Haoshenghuo. We have systematically selected respondents to avoid sex and age interference. And to ensure the integrity of the questionnaire, when a questionnaire has been filled out, it will be taken back immediately.

4.4.2.2 Questionnaire data preprocessing

Due to the affecting factors in the course of investigation, questionnaires cannot be directly used for data analysis. Before data processing, these questionnaires must be preprocessing and these void questionnaires will be excluded, or they will lead to distortion of the questionnaire results. The remaining valid questionnaires are sorted and we checked whether sample size in each level are in line with the sampling requirements, and if not, whether we should distribute more questionnaires.

4.4.2.3 Data statistics

We distributed 420 questionnaires, in which 394 questionnaires are valid, 12 questionnaires are invalid, and 14 questionnaires are lost. In addition, we planned to interview 20 customers (in each case), but actually, we only get accessed with 19 customers from Moge and 17 customers from Haoshenghuo. According to successful evaluation cases and customer satisfaction measurement cases, customer satisfaction evaluation criteria are set out as follows in Table 4-20.

Evaluation indicator	Score	Implication
1.Public image C₁	5	Very useful
	4	Useful
	3	Not bad
	2	A little bad
	1	Very bad
2.Advanced equipment C₂ (one point for one requirement)	1	Freezing or cooling functions
	1	CCTV
	1	Information processing automation

	1	QR code or bar code
	1	Touch screen system
3.Information accuracy D₁ (information error)	5	Frequently, every week
	4	Often, several times in one month
	3	Sometimes
	2	Seldom
	1	Never
4.Delivery delay rate D₂ (one unit per million units)	5	Under 1
	4	1-3
	3	3-4
	2	4-5
	1	Over 5
5.Parcel damage rate D₃ (one unit per million units)	5	Under 2
	4	2-3
	3	3-4
	2	4-5
	1	Over 5
6.Tracking ability D₄ (one point for one requirement)	1	App on cellphone
	1	SMS
	1	Online query
	1	Telephone query
	1	Delivery lockers query
7.Personalized service D₅ (one point for one requirement)	1	Water, gas and electricity fee payment
	1	Parcel storage
	1	Different sized lockers
	1	Parcel sending
	1	No extra charge in 3 days
8.Value-added D₆ (one point for one requirement)	1	Cooperation with online retailers
	1	Advertisement
	1	Lottery
	1	Biolateral charge

	1	Unilateral charge
9.Ability to handle disaster and accidents D₇ (one point for one requirement)	1	Fire extinguisher
	1	Alarm system
	1	Heightening lockers
	1	Specialized material lockers
	1	Rain-shelter
	10.Response D₈ (response to emergency)	5
4		Quickly
3		Not bad
2		Slowly
1		Very Slowly
11.Education D₉ (management personnel)	5	Postgraduate
	4	Undergraduate in top universities
	3	Undergraduate
	2	Junior college
	1	High school
12.Price acceptance E₁	5	Very fair
	4	Fair
	3	Not bad
	2	Unacceptable
	1	Very unacceptable
13.Price satisfaction E₂	5	Very satisfied
	4	Satisfied
	3	Not bad
	2	Not satisfied
	1	Super unsatisfied
14.Rivals competition E₃	5	Unilateral charge
	4	0.5 RMB/day
	3	1 RMB/day
	2	1 RMB/unit
	1	Biolateral charge

15.Satisfaction for complaint handling process F₁	5	Very satisfied
	4	Satisfied
	3	Not bad
	2	Not satisfied
	1	Super unsatisfied
14.Satisfaction for complaint handling time F₂	5	Very satisfied
	4	Satisfied
	3	Not bad
	2	Not satisfied
	1	Super unsatisfied
17.Satisfaction for complaint handling results F₃	5	Very satisfied
	4	Satisfied
	3	Not bad
	2	Not satisfied
	1	Super unsatisfied
18.Reuse possibility G₁	5	Strong Yes
	4	Yes
	3	Whatever
	2	No
	1	Strong No
19.Recommendation possibility G₂	5	Strong Yes
	4	Yes
	3	Whatever
	2	No
	1	Strong No
20.Long-run use possibility G₃	5	Strong Yes
	4	Yes
	3	Whatever
	2	No
	1	Strong No

Table 4-20 Evaluation implication of indicator

Statistical data obtained through questionnaires are shown in the following Table 4-21 to 4-23. From the data in Table 4-21, we can see that people who likes online shopping are 18-35 years old, and most of them are students and young people. People with a monthly salary of 2000-5000 yuan like online shopping. People shopping online every week accounted for 52%. People getting door to door delivery are about 55%. Door to door delivery is still the most common way to collect parcels. But in these areas equipped with delivery lockers form Moge and Haoshnghuo, like residential areas, college town and office buildings, 83% people have used delivery lockers, which population is 328, while 57% have used delivery lockers from Haoshenghuo and 43% have used delivery lockers from Moge.

With questionnaire data and Table 4-20, we get the average score of indicators for these two delivery lockers companies by calculations. The results are shown in the following Table 4-22 and 4-23.

Information	Implication	Number(person)	Total	Percentage(%)
Gender	Male	173	394	44
	Female	221		56
Age	18-25	85	394	21.5
	25-35	114		29
	34-45	71		18
	45-55	95		24
	Over 55	29		7.5
Salary	Under 2000 RMB	69	394	17.5
	2000-3000 RMB	118		30
	3000-5000RMB	138		35
	Over 5000 RMB	69		17
How often do you do online shopping?	Frequently, every week	205	394	52
	Often, several times in one month	99		25
	Sometimes	41		10.4
	Seldom	25		6.3
	Never	24		6
How do you usually	Door to door delivery	217		55

pick up your parcels?	Designated place in the residential area, working place or college town	122	394	31
	Delivery lockers	47		12
	others	8		2
Have you used delivery lockers?	No	78	394	20
	Yes	316		80
Public image	Haoshenghuo	232	394	58
	Moge	162		42
Which company' delivery lockers?	Haoshenghuo	187	316	60
	Moge	129		40

Table 4-21 Essential information of respondents

Person	1	2	3	4	5	Total	Average score
Public image C ₁	28	57	32	28	17	162	2.68
Information accuracy D ₁	29	36	25	26	13	129	2.66
Response D ₈	6	6	5	62	21	100	3.86
Price acceptance E ₁	11	22	58	35	3	129	2.96
Price satisfaction E ₂	13	41	53	19	3	129	2.67
Satisfaction for complaint handling process F ₁	1	9	2	3	4	19	3.04
Satisfaction for complaint handling time F ₂	7	1	1	8	2	19	2.87
Satisfaction for complaint handling results F ₃	1	9	6	1	2	19	3.00
Reuse possibility G ₁	16	44	15	35	19	129	2.99
Recommendation possibility G ₂	10	18	35	50	16	129	3.35
Long-run use possibility G ₃	15	15	37	45	17	129	3.28

Table 4-22 Score of Moge (Questionnaire)

Person	1	2	3	4	5	Total	Average score
Public image C ₁	56	104	53	12	7	232	2.18
Information accuracy D ₁	23	15	22	84	43	187	3.59
Response D ₈	10	15	11	23	6	65	3.01
Price acceptance E ₁	32	54	67	30	4	187	2.57
Price satisfaction E ₂	26	118	39	4	0	187	2.11
Satisfaction for complaint handling process F ₁	2	6	4	3	2	17	2.39
Satisfaction for complaint handling time F ₂	6	4	3	3	1	17	2.35
Satisfaction for complaint handling results F ₃	5	5	4	2	1	17	2.26
Reuse possibility G ₁	32	69	43	26	17	187	2.61
Recommendation possibility G ₂	41	65	32	43	6	187	2.50
Long-run use possibility G ₃	42	60	50	28	7	187	2.47

Table 4-23 Score of Haoshenghuo (Questionnaire)

In terms of response indicator, there are only 65 customers from Haoshenghuo and 100 customers from Moge who have had contact with personnel in these two companies because of information error or other problems.

In addition, we collected other data in the course of interview with these companies' managers and therefore scored for these two companies according to Table 4-20. The results are shown in Table 4-24.

	Haoshenghuo company	Score	Moge company	Score
Advanced equipment	QR code	3	More functional lockers	4
Parcel damage rate	5.40	1	3.29	3
Delivery delay rate	3.61	3	0.71	5
Tracking ability	Online query and SMS	3	App	5

Personalized service	Parcel storage	2	Water, electricity and gas fee payment	4
Ability to handle disaster and accidents	Alarm systems	2	Flood alarm system	1
Value-added service	Cooperation with online retailers	1	Lottery	3
Education	Junior college	2	Undergraduates in top universities	4
Rivals competition	Unilateral charge	5	Biolateral charge	1

Table 4-24 Score of these two companies (Interview)

Nanjing Moge has more advantages over Nanjing haoshenghuo in terms of advanced equipment. Users can track their parcels with apps on their cellphone and can pay their water, electricity and gas fees, even buy lottery tickets or withdraw cash with app or delivery lockers. Delivery lockers from Moge has more diversified personalized lockers while haoshenghuo has relatively uniform lockers, and it can't store irregular-sized parcels, which brings users inconvenience. We think this maybe a reason why parcel damage rate of Moge is lower than Haoshenghuo. In terms of delivery delay rate, Moge is also higher than Haoshenghuo, and this may result from the two ineffective tracking query methods, online query and SMS notifications, users cannot track the parcels timely. Almost all delivery lockers from Moge are set outdoors so it has no fire alarm system. But because there is rainier in southern China, so it has flood alarm system. While Haoshenghuo are more advantageous in terms of alarm systems, its delivery lockers are equipped with self-generating power system, fire alarm systems and burglar alarm system.

Speaking of value-added services, as we have mentioned, delivery lockers from Moge can sell lottery tickets and other services, while Haoshenghuo have no relevant services. And Moge has a two-way charge from couriers and recipients, the charge will increase each day if you don't collect the parcels, while Haoshenghuo only charge from couriers. So obviously Haoshenghuo has a competitive advantage of price over Moge.

In addition, by our field investigation, we find that these two companies have different management team. Management team from Haoshenghuo has an average age of more than 40 years old and are generally are less educated in colleges, all employed in express

delivery industries. While management team from Moge are all undergraduates and postgraduates with an average age of less than 30 years old, and there is a relatively mature research and development team.

Compared with the express delivery industry, we find that the complaint rate and parcel damage rate of this industry are calculated in unit per millions unit. In 2015, Haoshenghuo's parcel damage rate is 5.40%, delivery delay rate is 3.61%, which is below average in this industry, and both increased compared to 2014. Moge's parcel damage rate is 3.29%, delivery delay rate is 0.71%, both decreased compared to 2014, which is at a high level in the industry.

All the data involved in evaluation system have been collected, and all scoring has been done. Now according to indicator weights in each level, we can evaluate the performance of these two companies in terms of customer satisfaction.

4.5 Customer Satisfaction Degree Measurement

4.5.1 Customer Satisfaction degree calculation

Customer satisfaction formula:

$$CSI = \sum_{i=1}^n W_i C_i \quad (4.8)$$

CSI is customer satisfaction indicator, W_i is the indicator weight of indicator i , C_i is the score of indicator i .

With the indicator weights and score calculated above, the customer satisfaction degree calculation results are shown in Table 4-25.

				Haoshenghuo		Moge	
First class	Indicator weights in second level	Indicators	Relative indicator weights W_i	C_i	$W_i C_i$	C_i	$W_i C_i$
Corporate Image B ₁	0.04	Public image C ₁	0.01	2.18	0.03	2.68	0.03
		Advanced equipment C ₂	0.03	3.00	0.08	4.00	0.11
		CSI (B ₁)		0.11		0.14	
Service quality B ₂	0.39	Information accuracy D ₁	0.03	3.59	0.11	2.66	0.08
		Delivery delay rate D ₂	0.08	3.00	0.25	5.00	0.41
		Parcel damage rate D ₃	0.07	1.00	0.07	3.00	0.22
		Tracking ability D ₄	0.05	3.00	0.14	5.00	0.23
		Personalized service D ₅	0.05	2.00	0.11	4.00	0.22
		Value-added service D ₆	0.05	1.00	0.05	3.00	0.15
		Ability to handle disaster and accidents D ₇	0.01	2.00	0.02	1.00	0.01
		Response D ₈	0.03	3.01	0.09	3.86	0.12
		Education D ₉	0.01	2.00	0.02	4.00	0.05
CSI (B ₂)		0.87		1.49			
Service Price B ₃	0.28	Price acceptance E ₁	0.06	2.57	0.17	2.96	0.19
		Price satisfaction E ₂	0.08	2.11	0.17	2.67	0.22
		Rivals competition E ₃	0.08	5.00	0.39	1.00	0.08
		CSI (B ₃)		0.73		0.49	
Customer complaints B ₄	0.14	Satisfaction for complaint handling process F ₁	0.02	2.81	0.05	3.04	0.06
		Satisfaction for complaint handling time F ₂	0.05	2.35	0.11	2.87	0.13
		Satisfaction for complaint handling results F ₃	0.08	2.26	0.17	3.00	0.23
		CSI (B ₄)		0.33		0.42	
Customer loyalty B ₅	0.15	Reuse possibility G ₁	0.03	2.61	0.07	2.99	0.09
		Recommendation possibility G ₂	0.05	2.50	0.12	3.35	0.16
		Long-run use possibility G ₃	0.08	2.47	0.19	3.28	0.25
		CSI (B ₅)		0.38		0.49	
		Sum of CSI		2.41		3.03	
		Ranking		2		1	

Table 4-25 Customer satisfaction degree evaluation

4.5.2 Results Analysis

Table 4-25 is the final results of customer satisfaction degree evaluation for these two companies. According to the first class indicator weight, indicators affecting customer satisfaction are service quality, service price, customer loyalty, customer complaints, and corporate image in descending order. Then we will analyze the results of the final scores.

(1) Service quality

The indicator weight of service quality is bigger than others, which means that service quality is the most affecting indicator for customer satisfaction. It also shows that for consumers, in a service industry, service quality is more important than service price. From Table 4-25, we can see that Haoshenghuo gets a score of 0.87 in terms of service quality, while Moge has a score of 1.49, obviously higher than Haoshenghuo.

The score of service quality consists of nine third-class indicators, which are delivery delay rate(0.08), parcel damage rate(0.07), tracking ability(0.05), personalized service(0.05), value-added service(0.05), information accuracy(0.03), response(0.03), ability to handle disaster and accidents(0.01), education(0.01), in descending order. So, as the industry derived from express delivery industry; consumers are still most concerned about on time delivery, parcel damage, and additional services offered by the express companies. Information accuracy, employee education background, and disaster prevention may get less attention from customers.

In terms of service reliability, Moge gets higher scores than Haoshenghuo in delivery delay rate, parcel damage rate, and tracking ability but a lower score in information accuracy, which is 2.66 lower than 3.59. Obviously, Moge has to improve their information transmission ability, but it still has a higher level of service reliability in general. In terms of service integrity, Moge gets higher scores than Haoshenghuo in personalized services and value-added services but a lower score in ability to handle disaster and accidents. In terms of professional staff, Moge gets an absolute advantage over Haoshenghuo. Although consumers do not pay attention to staff specialization degree, however, in the long-run, the more professional staff is, the better service this company can provide, which is the key to enterprise's core competitiveness.

(2) Service price

The importance of service price ranks the second, Haoshenghuo has a score of 0.73 in terms of service price, while Moge has a score of 0.49, obviously lower than Haoshenghuo.

In addition, the score of service price consists of three third-class indicators, which are price satisfaction (0.08), rivals competition (0.08), and price acceptance(0.06), in descending order. So when consumers are faced with choices of express companies, they are willing to choose the cheapest one.

In terms of scores, there are no much differences in price satisfaction and price acceptance, Moge is 2.96 and 2.67 while Haoshenghuo is 2.75 and 2.11. However, Haoshenghuo gets a higher score of 5 than Moge, which is only 1. As already mentioned earlier, Haoshenghuo has quite lower charges than Moge, only for couriers by numbers of parcels. While Moge has two-way charges, and charges will increase according to the number of days. But in this case, Moge still gets higher scores in price satisfaction and price acceptance, which may result from its higher service quality. So service quality indirectly affects price satisfaction and price acceptance.

(3) Customer Loyalty

Customer loyalty means a repeated preference for an enterprise and its products when consumers making purchasing decisions. In Table 1-25, we can see that Moge has a higher score of 0.49 in terms of customer loyalty than Haoshenghuo, which is 0.38.

Customer loyalty consists of present customer loyalty and long-run customer loyalty. Present customer loyalty includes reuse possibility and recommendation possibility and long-run customer loyalty means long-run use possibility. Arranged in descending order, they are long-run use possibility (0.08), recommendation possibility (0.05), and reuse possibility (0.03). By a lot of interviews with consumers, we find that most consumers will reuse a product or service when they are satisfied with it, then they will recommend it to people around, and finally be loyal to it in the long run.

Moge gets scores of 3.22, 3.35, 3.28 in these three indicators, while Haoshenghuo is 2.47, 2.50, 2.61. It can be clearly seen that Moge gets an average score of about 3, while Haoshenghuo is only 2.5, which indicates that Moge has had their loyal customers and Haoshenghuo still has a lot to do in the future.

(4) Customer complaints

Customer complaints are derived from being dissatisfied with a product or service, which means that the product or service provided by operators does not reach their expectations or does not meet their needs. On the other hand, it also means that customers still have the expectations for operators and are looking forward to the improvement of the service level, and its direct and main purpose is to get compensation for their economic losses.

In terms of satisfaction for complaint handling based on the customer satisfaction evaluation indicator system in this survey, they are satisfaction for complaint handling results (0.08), satisfaction for complaint handling time (0.05), and satisfaction for complaint handling process (0.03), in descending order. This means that most consumers pay more attention on handling results rather than process and time.

From TTable 4-25, we can see that in terms of complaint handling, Moge gets a higher score of 0.42 than Haoshenghuo, which is 0.33. Moge gets scores of 3.0, 2.87, 3.04 in these three indicators, while Haoshenghuo is 2.26, 2.35, 2.81, which are all lower than Moge. If Haoshenghuo wants to improve its customer loyalty, Haoshenghuo should pay more attention to complaint handling.

(5) Corporate image

Corporate image refers to people's overall perception of an enterprise. When an enterprise has established its good corporate image in the public, consumers are willing to buy its products or receive its services. Otherwise, consumers will not buy its products or services. However, if enterprises want to establish a good public image, the first thing they should do is to provide excellent products or services. Secondly, through a variety of means, like advertisement, enterprises get themselves promoted.

Based on the customer satisfaction evaluation indicator system in this survey, corporate image refers to public image and asset. Among them, asset refers advanced equipment and facilities. In terms of indicator weight, advanced equipment is 0.03, while public image is 0.01. It shows that consumers pay more attention to the equipment when they use delivery lockers.

From Table 4-25, we can see that in terms of corporate image, Moge gets a higher score of 0.14 than Haoshenghuo, which is 0.11. Moge gets scores of 4.0, 2.68 in these two indicators, while Haoshenghuo is 3.0, 2.18, which are all lower than Moge. And by field investigation, we find that as an emerging company, Moge are more advanced in locker itself and the functions it provided than Haoshenghuo. Although Haoshenghuo is the first delivery lockers provider and owns the largest market share, but is backward in innovation and technology.

In general, considering of all five aspects, Moge has a score of 3.03 higher than Haoshenghuo's 2.41. In this customer satisfaction degrees survey, Moge has a better performance than Haoshenghuo. The main reason is that Moge pays more attention to consumer service experience, mainly focusing on developing more advanced equipment. Although Haoshenghuo has a huge price advantage, it will only be temporary advantage in developing modern society. If they want to occupy broader market, or have more potential consumers accepted of delivery lockers, they still need to focus on improving service quality and pay more attention to customer complaints.

5.0 Economic Operating Efficiency

To better understand the operational situation of delivery lockers, we will analyze its costs, profit, and revenue in terms of economic operation.

5.1 Costs

(1) Equipment costs

From Table 5-1, we can easily find that equipment costs differ from delivery lockers providers, which is of quite large difference.

Delivery lockers provider	Price (rmb/set)
Nanjing Moge (40 lockers)	15800
Nanjing Haoshenghuo (40 lockers)	23000
Nanjing Lanxin (40 lockers)	25000
Nanjing Pengke (32 lockers)	28000
Average price	22950

Table 5-1 Delivery lockers price

Source: Alibaba website and company interview

(2) Electricity costs

According to electricity tariff in China, we calculate electricity costs as

Electricity costs = electricity charge (Peak and valley method) + electricity charge (Ladder method)

	Time period	Electricity costs (rmb/degree)
Peak period	21:00 — 08:00 (the next day)	0.3583
Valley period	08:00 — 21:00	0.5583

Table 5-2 Peak and valley method

	Degree	Extra charge (degree/rmb)
First class	under 231	0
Second class	231– 400	0.05
Third class	over 400	0.3

Table 5-3 Ladder method (monthly)

*These two methods are applied by Price Bureau of Jiangsu Province, with the principle "firstly Peak and valley method, secondly Ladder method".

Usually, a delivery locker work as normal for 24 hours every day, and monthly electricity consumption is about 360 degrees, about 20 degrees every day, which means 0.625 degree / hour. According to the electricity tariff in Table 5-2 and Table 5-3, the electricity charge is calculated as follows:

Electricity charge (Peak and valley method) = $0.625 \times 11 \times 0.3583 + 0.625 \times 13 \times 0.5583 \approx 7.0$ rmb

Electricity charge (Ladder method) = $(360 - 230) \times 0.05 = 6.5$ rmb

Daily electricity charge = $7.0 + 6.5 / 30 \approx 7.2$ rmb

(3) Maintenance costs

Maintenance costs for a delivery locker is mainly for maintenance of its display screen system, and according to managers in these companies, this costs will be average 2000 rmb / year, which means 5.56 rmb / day.

5.2 Profit

In the present, profits of delivery lockers are mainly from charge for users. According to different charges and locations, if parcels volume in a residential area is about 200 / day and a university is about 500 / day, then the following results are obtained, which are shown in Table 5-4:

Charge (rmb/day)	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
Residential area	20	40	60	80	100	120	140	160	180	200
University	50	100	150	200	250	300	350	400	450	500

Table 5-4 Daily profit forecast of a delivery locker

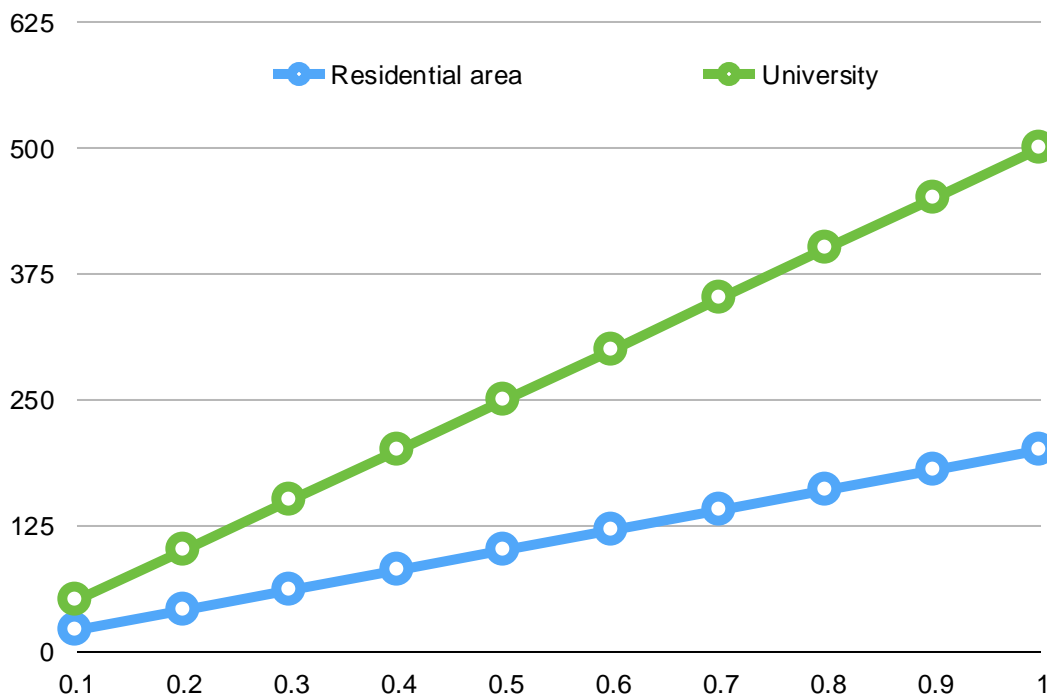


Figure 5-5 Daily profit forecast of a delivery locker

As it can be seen from Figure 5-5, with the increasing charge of a delivery locker, the daily profit of a delivery locker will also increase, daily profit and charge are of a positive linear correlation.

5.3 Revenue

(1) We calculate revenue as

$$\text{Revenue} = \text{Profit} - \text{Electricity costs} - \text{maintenance costs}$$

A delivery locker has about 40 lockers, according to the parcels volume of different locations, if all parcels are delivered by delivery lockers, then there should be five sets of delivery lockers in a residential area, and 13 sets in a university. Therefore, for example, if a delivery locker is charged for 0.1 rmb / day in a residential area, daily revenue excluding depreciation is

$$20 - (7.2 + 5.56) \times 5 = -43.8$$

so the revenue is as shown in Table 5-6.

Charge (rmb/day)	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
Residential area	-43.8	-23.8	-3.8	16.2	36.2	56.2	76.2	96.2	116.2	136.2
University	-115.88	-65.88	-15.88	34.12	84.12	134.12	184.12	234.12	284.12	334.12

Table 5-6 Daily revenue forecast of a delivery locker (excluding depreciation)

(2) Depreciation refers to the decrease in value of assets due to the use of the assets.

Depreciation of fixed assets should be included in the revenue calculation, so the revenue formula should be

$$\text{Revenue} = \text{Profit} - \text{Costs (Electricity costs + Maintenance costs)} - \text{Depreciation}$$

And depreciation can be calculated with Straight-line method, which formula is as follows.

$$\text{Annual depreciation rate} = (1 - \text{residual value rate}) / \text{useful life of assets (years)}$$

$$\text{Monthly depreciation rate} = \text{annual depreciation rate} / 12$$

$$\text{Depreciation expense} = \text{depreciation rate} \times \text{cost of fixed assets}$$

If the useful life of the delivery lockers is about 8 years, then according to the formula above, we can calculate the depreciation as follows, and the results are shown in Table 5-7.

$$\text{Annual depreciation rate for a delivery locker} = (1 - 0.05) / 8 = 0.11875$$

$$\text{Monthly depreciation rate} = 0.11875 / 12 = 0.01484$$

$$\text{Monthly depreciation expense for a residential area} = 0.01484 \times 22950 \times 5 = 1702.89 \text{ rmb}$$

$$\text{Daily depreciation expense for a residential area} = 1702.89 / 30 \approx 56.76 \text{ rmb}$$

$$\text{Monthly depreciation expense for a university} = 0.01484 \times 22950 \times 13 = 4427.514 \text{ rmb}$$

$$\text{Daily depreciation expense for a university} = 4427.514 / 30 \approx 147.58 \text{ rob}$$

*Due to information provided from the managers in these companies, we make a forecast for good life of the delivery lockers, which is higher than 5 years in "Enterprise Income Tax Law Implementing Regulations for People's Republic of China", the regulation 60 "electronic devices in fixed assets is of 5 years useful life", and the residual value rate is usually 5%.

Charge (rmb/day)	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
Residential area	-100.56	-80.56	-60.56	-40.56	-20.56	-0.56	19.44	39.44	59.44	79.44
University	-263.46	-213.46	-163.46	-113.46	-63.46	-13.46	36.54	86.54	136.54	186.54

Table 5-7 Daily revenue forecast of a delivery locker

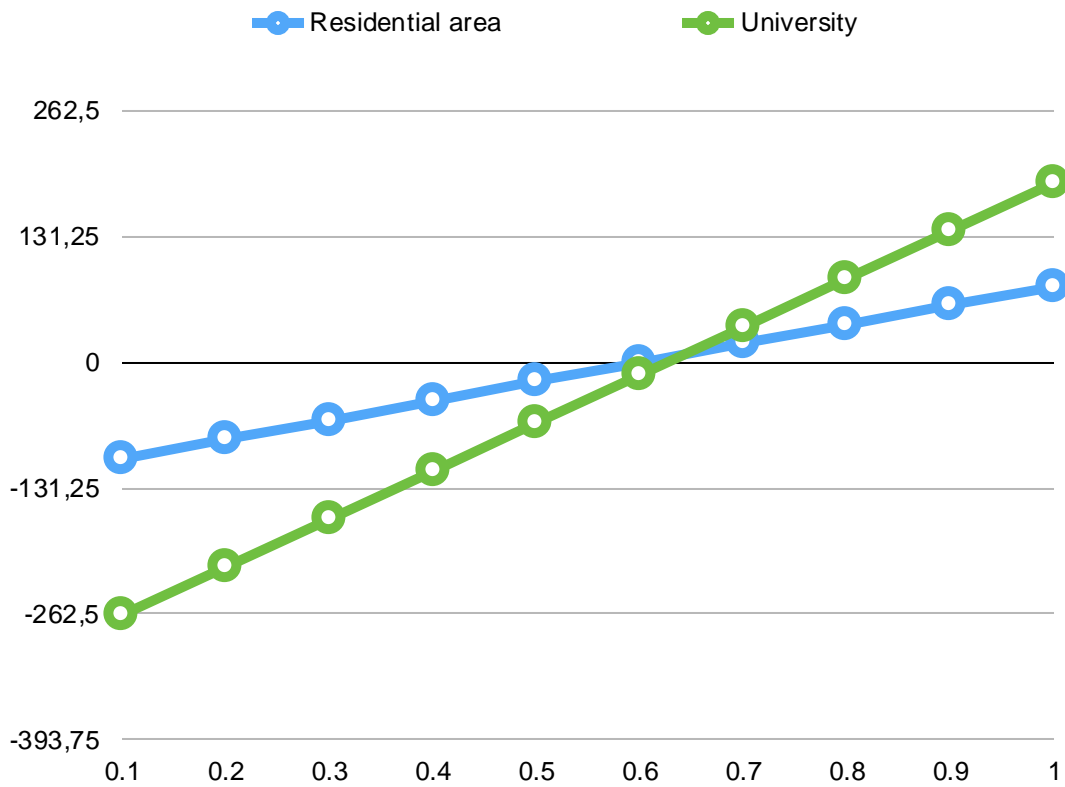


Figure 5-8 Daily revenue forecast of a delivery locker

As it can be seen from Figure 5-8, daily revenue of a delivery locker increases when charge increase, and these two factors are of a positive linear correlation, and the correlation coefficients are parcels volume in residential areas and universities.

5.4 Results

Costs for delivery lockers mainly consist of equipment costs, electricity costs, and maintenance costs. There is little choice for delivery locker providers, but still the prices from different delivery locker providers differ so much. The most expensive delivery locker will cost 28,000 rmb, while the cheapest delivery locker only costs 15,800 rmb, the average price of delivery locker is 22,950 rmb. As the most important part of costs, and also the large part of costs, equipment costs are calculated as depreciation during the calculation of revenue. Compared to equipment costs, electricity costs is just a small part of the whole costs, though delivery lockers provided a 24 hours service. In everyday life, when electronic devices have been used for more than five years, there will be certain maintenance costs and it increases year by year. So it is assumed that delivery locker's

useful life is 8 years, then normal maintenance costs every year is a relatively small amount of money. Overall, delivery locker is a small investment with relatively lower costs.

Profit of delivery lockers are mainly from charge for users who take service of delivery lockers. It can be seen from Figure 5-1 that there is a positive correlation between profit and charges, higher the charge, higher the profit. But in real life, higher charge does not increase profit. On the contrary, it will decrease the profit, and as the correlation coefficient, parcels volume is the key to increase profit. In the era of online shopping, the parcels volume in residential areas and universities will increase instead of decreasing in the future for a long period of time, therefore, profit will also continue to increase.

From the revenue forecast of delivery lockers, if excluding equipment depreciation, and just deducting electricity and maintenance costs every day, no matter where these delivery lockers locate, in residential areas or in universities, as long as the charge is over 0.3 rmb / day, delivery lockers will be profitable. However, if including the equipment depreciation, it can be seen from Figure 5-8, no matter where these delivery lockers locate, in residential areas or in universities, as long as the charge is under 0.7 rmb / day, revenues of delivery lockers are always negative. When charge is 0.7 rmb / day, revenues is positive, but is also extremely low. Of course these revenue calculations and forecasts are hypothetical, in which case that all profits are from charge for users. However, if the delivery lockers providers cooperates with e-commerce companies, there will be other profits from advertising, or they becomes one part of the supply chain, there will be more profitable.

6.0 Problems

This chapter focuses on summarizing problems existing in delivery lockers services provided by delivery lockers companies in Nanjing, with market information we have collected in interview and field investigation, and analysis we have done about operating efficiency and customer satisfaction degree evaluation for delivery lockers in Nanjing.

6.1 Operating costs and revenue

6.1.1 Investment

Because the existing delivery lockers put in the market have different delivery lockers providers or manufacturers, there is no unified investment program and investment amount. The existing delivery lockers put into operation in Nanjing primarily provide services for dwellers in residential areas and students in universities. In general, there are two motivations to put delivery lockers. One is for market requirements. Delivery lockers providers like Moge and Haoshenghuo, they put their delivery lockers to seek for more profits, usually in residential areas and universities where have a quite large parcels volume. And in this case, delivery lockers providers own all profits. In other case, property management company in residential areas and universities will invest for delivery lockers, so all profits belong to property management company in residential areas and universities.

In general, for dwellers in residential area, parcels usually are door to door delivered by couriers, so to get the parcels is not difficult. But property management companies are trying to strengthen safety supervision in residential areas, so many residential areas are under increasingly strict management and equipped with more safety facilities. In such residential areas, people who are not dwellers are generally not allowed to enter, of course, couriers are not allowed as well, and dwellers can only pick up parcels in the main gate of this residential area, or guards in the main gate will pick up parcels on behalf of the dwellers.

However, this pick up by guards also leads to so much unnecessary disputes between the property management company and the dwellers. For this case, delivery lockers have a great

advantage for solving such problems, but most of property management companies still hesitate to put delivery lockers in their residential areas. On the one hand, from results from the survey we have conducted, a residential area generally needs 5 sets or more intelligent delivery lockers to meet the demand of their dwellers, so property management companies requires a minimum one-time investment of more than 115000 rmb. On the other hand, they are afraid of more problems resulting from hastily introducing delivery lockers, such as extra property management charge. For property management companies, they cannot make an investment in vain, so in order to get investment returns. It is bound to add extra property management charge, which will certainly cause a lot of dissatisfaction from their dwellers and the problems between the property management companies and the dwellers may further upgrade. At the same time, there are little external operators willing to invest in such residential areas, so there is still a lot to do with promotion of delivery lockers in residential areas.

6.1.2 Costs resulting from outdoor operating — maintenance costs

From the third chapter of this paper, we found that another important expenditure for the delivery lockers is maintenance and repair costs. Currently, delivery lockers ensure the safety of parcels with its built-in intelligent system and surveillance video equipment, but it requires a large investment costs, which is clearly a major obstacle for newly emerging delivery lockers providers. And delivery lockers now in use and in sale by manufacturers are all installed outdoors, although they are equipped with rain-shelters, but in rainy days, these delivery lockers will inevitably suffer from the impact of rains, especially for electronic devices. And because delivery lockers is like computers with information management systems, and computers often are faced with problems like dissipating heat, especially in summer days. Another problem must be mentioned is vandalism, damage form natural factors accumulates day by day and month by month and may not have direct impacts on delivery lockers, but human-caused vandalism will make deadly damages on delivery lockers. Therefore, post-maintenance operation for outdoor delivery lockers is really a big problem.

6.2 Customer satisfaction degree

In Chapter 4, we conducted customer satisfaction degree evaluation about two most representative delivery lockers providers in Nanjing, Nanjing Moge, which owns the most advanced delivery lockers in the market and Nanjing haoshenghuo, which owns the biggest market share in the market. We collected data by personal interview, field investigation and questionnaire and analyzed data with Analytic Hierarchy Process. Then there are problem existing in five major criterion in Analytic Hierarchy Process, which are corporate image, service quality, service price, customer complaints, customer loyalty.

Ranking	First class	Weight
1	Service quality	0.39
2	Service Price	0.28
3	Customer loyalty	0.15
4	Customer complaints	0.14
5	Corporate Image	0.04

Table 6-1 Ranking of first class

Ranking	Second class	First class they belongs to	Relative indicator weight
1	Delivery delay rate D ₂	Service quality	0.08
1	Price satisfaction E ₂	Customer complaints	0.08
1	Rivals competition E ₃	Customer complaints	0.08
1	Satisfaction for complaint handling results F ₃	Customer complaints	0.08
1	Long-run use possibility G ₃	Customer loyalty	0.08
7	Parcel damage rate D ₃	Service quality	0.07
8	Price acceptance E ₁	Customer complaints	0.06
9	Personalized service D ₅	Service quality	0.05
9	Value-added service D ₆	Service quality	0.05
9	Tracking ability D ₄	Service quality	0.05
9	Recommendation possibility G ₂	Customer loyalty	0.05

Ranking	Second class	First class they belongs to	Relative indicator weight
9	Satisfaction for complaint handling time F ₂	Customer complaints	0.05
10	Information accuracy D ₁	Service quality	0.03
10	Response D ₈	Service quality	0.03
10	Reuse possibility G ₁	Customer loyalty	0.03
10	Advanced equipment C ₂	Corporate Image	0.03
11	Satisfaction for complaint handling process F ₁	Customer complaints	0.02
12	Public image C ₁	Corporate Image	0.01
12	Education D ₉	Service quality	0.01
12	Ability to handle disaster and accidents D ₇	Service quality	0.01

Table 6-2 Ranking of second class

In Chapter 4, we have calculated weights of the five first class indicators and second class indicators in customer satisfaction degree evaluation. Here we arrange these indicators in the following descending order, and from these indicators sorted, we can find the problem need to be solved first. The results are as shown in Table 6-1 and 6-2.

6.2.1 Service quality

According to respondents, service quality is the most affecting factor for customer satisfaction, when they choose whether use the delivery lockers. In Table 6-2, we find that delivery delay rate wins the first place among these indicators in first class service quality, which means it affecting customer satisfaction most than other 20 second class indicators. Here following the descending order of these affecting factors, we will state problems existing in delivery lockers market in Nanjing.

(1) Delivery delay rate and Parcel damage rate

On time delivery and the completeness of the package is most important for customers, when

they choose parcel delivery services, and they are important indicators for service quality. From our survey, as shown in Table 4-23, Nanjing Moge gets 5 out of 5 points in delivery delay rate and 3 out of 5 points in parcel damage rate, while Nanjing Haoshenghuo gets 3 out of 5 points in delivery delay rate and 1 out of 5 points in parcel damage rate. Comprehensively speaking, as a delivery lockers provider which owns the biggest market share in the market, Haoshenghuo is extremely not qualified in aspects of delivery delay rate and parcel damage rate. According to news and customer complaints over the past years, there are a considerable number of customers encountering such problems, that they received damaged parcels when they used delivery lockers from Haoshenghuo. But because parcels are not received by recipients from couriers, they are stored in delivery lockers and picked up by recipients. So about customer complains of damaged parcels, when couriers declare that parcels are intact when they put them into the delivery lockers, it is difficult to determine who is responsible for these damaged parcels.

Although Moge gets a quite high score in parcel damage rate, they also gets a relatively low score in parcel damage rate, which is an important affecting factors for customers to choose delivery services. These low scores of these two companies reflect that in current delivery lockers market, high parcel damage rate has become a big problem for delivery lockers providers to develop its business. It seriously affects its customers and its promotion.

(2) Personalized service and Value-added service

Single service, is also a main problem for delivery lockers development in Nanjing. In Nanjing, of all existing manufacturers and operators surveyed, their delivery lockers can only provide parcels self-pickup service, and cannot function with parcels self-sending service or other services. As the most advanced delivery lockers, Moge also has no improvement in such aspects, it still focuses on how to improve and perfect its parcels self-pickup service. They add an parcels returning service and lottery sale service, however, such services just meet customers' needs for the rapidly growing delivery service market in short term. For long-term delivery lockers development, it is not helpful and even has a restriction effect. Compared with Moge which focuses on services innovation, Haoshenghuo makes less improvement and investment in research and development. It gets 1 out of 5 points in personalized services and 2 out of 5 points in value-added services. For developing delivery

services market in Nanjing, such market reaction capacity and adaptive capacity will be restrictions and obstacle for Haoshenghuo, and Moge is just slightly superior to Haoshenghuo in these aspects.

For those delivery lockers located in college town, there is fierce competition between these companies and delivery stations. Delivery stations offered more diversified services. For college students who are very inconvenient to pick up their parcels, delivery stations set up nearby college town, no doubt, is a good choice. Moreover, delivery stations is still run by manual labor, so compared by delivery lockers which are totally by machines, it can offer a variety of integrated services, in addition to send and receive parcels, it can even works as a multifunction agency, offering driving school services and tourism services to satisfy the various needs of college students. These service appeals much for college students than delivery lockers. And many delivery stations are providing free parcel pickup service and parcels sending services with more choices of express companies, while delivery lockers only has parcels pickup services. Thus, such delivery stations, for delivery lockers, it is undoubtedly the most competitive rival.

Also parcels size is another major problem. In the era of online shopping, almost anything can be purchased online, people no longer have to go to the supermarket or shopping mall, and many large appliances can also be bought online. Therefore, a variety of large and unconventional parcels will appear in couriers' delivery vehicles. Moge and Haoshenghuo have offered a various sized locker, such as 130mm * 400mm * 570mm, 220mm * 400mm * 570mm, and 390mm * 400mm * 570mm lockers, but other delivery lockers only have uniform lockers. In this case, delivery lockers still cannot meet requirements from large and unconventional parcels, so if no one pick up the such parcels, courier still have to deliver for the second time or the third time.

(3) Tracking ability and Information accuracy

Although it's automatically SMS sending system allows delivery lockers have incomparable superiority, but such function also brings a lot of risks. With news and interviews, we found that, although Nanjing Moge has a high score in tracking ability, it only has a low score of 2.66 in information accuracy. Some respondents have told us that they often receive two

pickup code, and in which only one of them is correct to open the lockers. In the era of information explosion, especially in China, people often receive a lot of advertisement SMS and in order to protect users from these text-message harassment, many communications operators will automatically filter these harassment text-message for users. So SMS automatically sending by delivery lockers will be identified as harassment text-message, sometimes recipients cannot receive these SMS and get the pickup codes, then these parcels in the delivery lockers cannot be picked up. Generally, after couriers put parcels in delivery lockers, they will take away the waybill, which means there is no need for recipient's signature. And couriers will not notice whether these parcels are picked up by recipients and actually, they are unable to check these parcels in delivery lockers, which leads to some blame on couriers for delayed delivery and they have to sustain some economical losses. And faced with no signature delivery, recipients have to undertake the results like damaged parcels and cannot blame for express companies.

One another problem raised by questionnaire respondents is that when couriers put the parcels in delivery lockers, it is usually considered that this parcel has been successfully delivered. So if something is wrong with the parcels, who should be blamed for it, express companies and delivery lockers operators shirk responsibility to each other, this is becoming a question.

(4) Response and Education

Response capacity to accidents and emergency often indirectly reflects the service level of service-oriented industry. In the perspective of data results, Moge and haoshenghuo both have a score of about 3 points, which is not a satisfactory score, and it is a relatively serious problem for service-oriented industry. For first several times consumers use delivery lockers, if accidents and emergency occur, such as information mistakes and parcels damage or loss, capacity to handle these accidents and emergency determines the possibility of reuse and long-term use of these customers.

From the data, we can see that Moge y gets a higher score of 4 points in management personnel education level. And we can firmly believe that is why it owns the most intelligent delivery lockers and its market share is rapidly growing. While Haoshenghuo established much earlier than Moge, and although its management personnel are experienced

management workers in other industries, their age and education have no advantages over Moge, and they have no talented recruitment in their staff, so in recent years, it is weak in consumers and market.

From the ranking for indicator weights, although managers and consumers think education level is not very significant for customer satisfaction, development of delivery lockers market in Nanjing still relies on more innovative spiritual team.

(5) Ability to handle disaster and accidents

For delivery lockers' ability to handle disaster and accidents, these two delivery lockers providers in Nanjing both gives exceptionally low scores, 1 and 2 out of 5 points. Both of them equip their delivery lockers with rain shelters to protect from water getting into the machine. Compared to Haoshenghuo, Moge has an improvement in material of delivery lockers. Although currently the public pay little attention to delivery lockers' ability to handle disaster and accidents in the rankings, but with the society development, more and more people are interested in online shopping, products they buy online will be more and more valuable, security concerned with delivery lockers where people put their parcels will be more and more emphasized. Because if parcels stored in delivery lockers is stolen or damaged, then what the delivery lockers providers will be faced is collapse of consumer confidence in their service, loss of potential consumer groups, and huge financial compensation. So every delivery lockers provider should attach importance to delivery lockers' ability to handle disaster and accidents.

6.2.2 Service Price

Whether delivery lockers should charge and how much should it charge, such problems are controversially discussed. From the survey data, we can see that these two delivery lockers companies get scores under 3 points, both in price acceptance and price satisfaction, which means that respondents are not satisfied with their service price. Some other delivery lockers providers in Nanjing, in order to promote their lockers, chose to temporarily provide free services, this would no doubt be able to attract users, but in long-term, this free service will undoubtedly make investors lose everything. As we have already mentioned in the third

chapter, when there is no other value-added services, only charging of 0.7 rmb / day can prevent companies from economical losses. More company, in order to recover the costs as soon as possible, provides paid services for couriers, the average charge is 1 rmb / time.

As a result, delivery lockers providers are able to recover the costs, but also caused discontent from courier. Because couriers' salary is calculated by piece of parcels, they earn 0,5 rmb / piece. Such charge by delivery lockers, couriers do not earn money but lose money, so this charging model also allows investors lose everything. At the same time, Moge also charges for recipients, which is two-way charging, but due to the high charge, it also caused the dissatisfaction of recipients. For recipients, after paying for express fee, couriers one-time delivery or second-time delivery do not affect their benefits, so some prefer to delay the delivery for some days rather than choosing the delivery lockers. So in this case, Moge has no advantage in service price, on the one hand, their competitive advantages significantly reduces, on the other hand, they lost a large part of the market.

6.2.3 Customer loyalty

Moge gets a score of 3 points in customer loyalty, 0.5 point higher than Haoshenghuo. Attentive service and advanced equipment helps Moge to win more consumers. But people always have hesitating attitude to new thing, so even though delivery lockers satisfy people's needs and solve the problems, its innovative business model and charging make so many people doubtful and still prefer to continue using the original delivery method and are unwilling to use delivery lockers for convenience, which is also a huge challenge for the promotion of delivery lockers.

6.2.4 Customer complaints

For these two delivery lockers providers we have studied, there is a same problem of paying little attention to customer complaints, they both score for around 3 points, which means they only get about 60% customer satisfaction degree from customers. In the telephone interview process, we found that the common problems in these two companies is that customers generally considered that their complainants did not get enough attention, they

are more satisfied about complaint handling process and complaint handling time than complaint handling results. In this context that employees in companies is not highly concerned about customers' problems when they receive customer complaints, the customers will feel that companies do not pay attention to their problems and unwilling to resolve the problem. This cannot lower the dissatisfaction of customers in their mind, but also lose customers' trust and make them have negative attitudes to enterprises, which finally reduce customer satisfaction and customer loyalty.

6.2.5 Corporate Image

Both two delivery lockers get scores over 3 points in terms of advanced equipment, in recent years; convenience and practicality of their lockers have made great progress. For Moge, scanning QR and then picking up parcels makes delivery lockers' efficiency greatly improved. However, they both get low scores in terms of public image, and Moge is 2.68 points slightly higher than Haoshenghuo company's 2.18 points. After the field investigation, we believe these two companies generally have simplified the concept about corporate image. They think corporate image can be simply established by designing some corporate logo, product trademarks and standard color design. But they are considering about its visual effects, and that corporate image is just a few people's behavior. Actually, they do not realize that core of the corporate image is business philosophy.

7.0 Suggestions

7.1 Regulation about delivery lockers providers

Currently, for delivery lockers put in the market in Nanjing, different manufacturers and operators run their own business, such as for delivery lockers production, there are different sized and shape lockers, these lockers has no uniform standard. So does the delivery lockers information system, is still not mature and stable. In perspective of operating, there is no clear regulation about responsibilities, so after a problem occurs, responsibilities are shifted to each other and finally customers undertake loss. So, for now, the most important thing is setting detailed sets of clear rules and regulations about delivery lockers. These rules and regulations can be concerned about delivery lockers production and guidelines of delivery lockers providers. To make the delivery lockers market to rapidly regulated and standardized, these must comply with strong constraints from the law. At the same time, promotion by related department in the country, can not only prosper the industry, but also make it easier for the public to accept such a new service. Nanjing is a city with residential population of 821.61 million, improving express delivery efficiency and facilitating logistics industry healthily and rapidly developing are also an important goal of local government. In addition, improving and upgrading of delivery lockers' core information system cannot only rely on small private enterprises which lacks capital but also should needs support from government.

7.2 Improving delivery lockers

(1) Building delivery lockers room

Taking post-maintenance of delivery lockers into account, when determining to invest delivery lockers and deciding its location, investors should consider about various factors, such as sunlight, humidity and etc. The best way is to build a delivery lockers room, indoor environment will protect these lockers from some natural factors, if capital are adequate, even some of cooling equipment can be placed inside or ventilation system can be designed and installed inside.

(2) HD surveillance camera and alarm systems

All delivery lockers should be equipped with HD surveillance cameras. When couriers are using these lockers, they are totally monitored. If there is a problem with parcels, related videos can be retrieved at any time to solve disputes. And if there is intentional destruction or theft, these cameras can promptly identify crime and help investigate for legal responsibility according to the law. In our views of opinions, also alarm system is necessary to install, in the case of encountering outside vandalism, like fire or flood, it can make an alarm in time, to provide guarantee for parcels safety.

(3) Improving system functions

Delivery lockers also need to improve its system functions. The intelligent system can send a text message to couriers for every 12 hours, to inform them the charged situation of parcels, whether it is still stored in the delivery lockers or has been picked up. Thus, if the parcel has been stored for a long time, couriers can call the recipients to confirm whether they have received the text message, if it is filtered as harassment messages, recipients can be reminded. In addition, for phenomenon that unconditional occupation of public resources for a long time because recipients cannot pick up parcels timely, delivery lockers can add additional charges for overtime storing services, specific charge such as within three days, recipients are free to pick up their parcels with pickup codes, after three days, recipients should pay an additional fee for picking up the parcels.

(4) Additional waybill box

For problems "no signature delivery", there can be additional waybill box for different express companies besides the delivery lockers. So couriers do not need to take away the waybills. Recipients can sign by themselves when picking up, and remove the waybill and throw into the corresponding box. If there is a problem with parcels, recipients can refuse to sign and blame express companies for responsibilities.

(5) Reasonable larger sized lockers

Although delivery lockers operators have conducted a survey about the most common size of parcels, and customized different lockers on such a basis, but there are still many large sized parcels cannot be put in the delivery lockers. Delivery lockers companies can add a few large lockers to put some other special shaped or large parcels.

(6) Parcel sending function

To handle competition from delivery stations, delivery lockers can add parcels sending function to better satisfy customers' needs. The detailed operation process is shown in Figure 7-1, which is referred to a delivery lockers provider in Beijing.

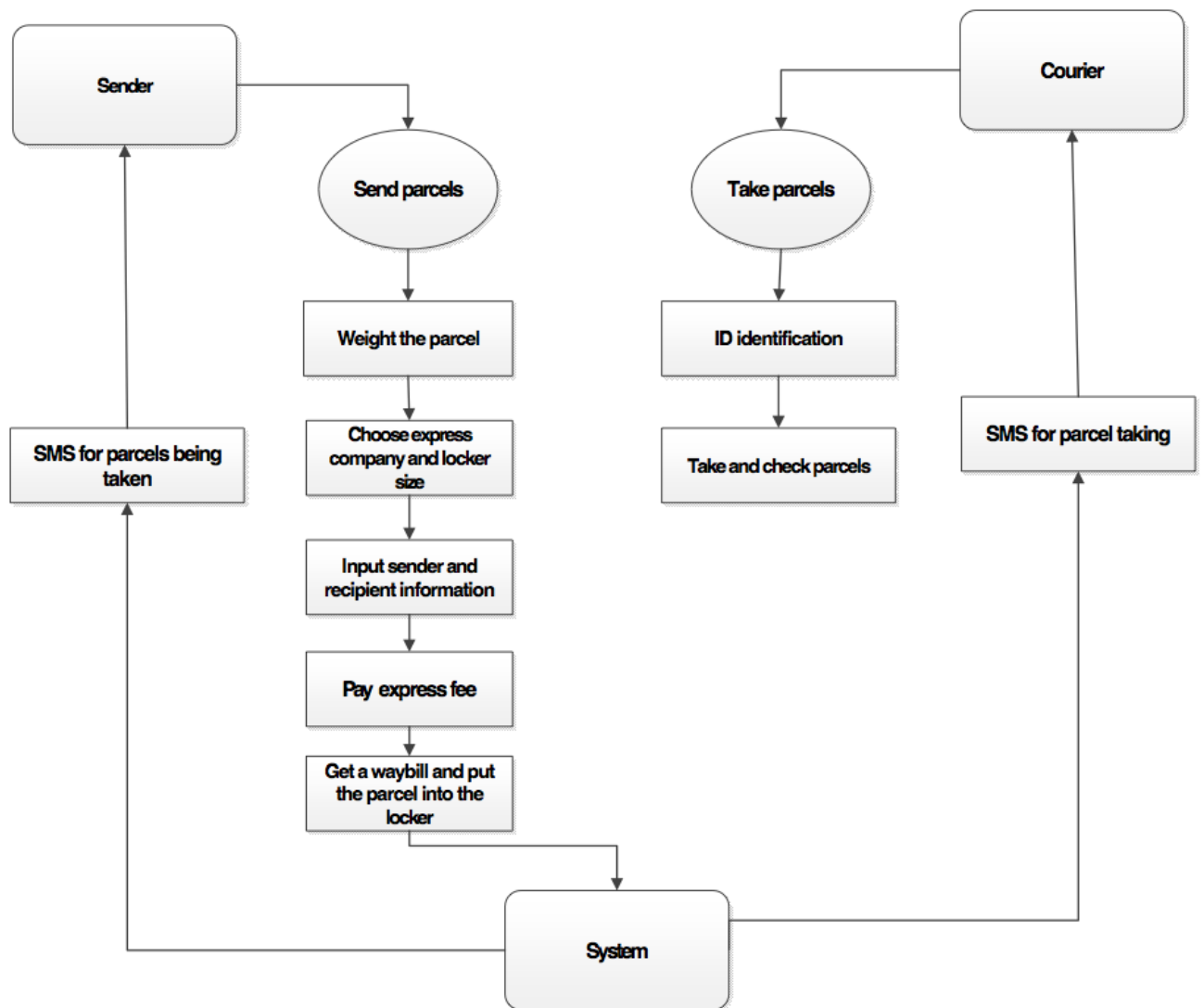


Table 7-1 Self-help parcels sending process

1) Sending procedures

Sender operational procedures

- i Weight a parcel and its weight will be automatically input in the system and shown in the screen.
- ii Select express company and locker size, input sender and recipient information.
- iii Express fee will be calculated and shown in the screen, sender confirm all information.
- iv Pay for express fee.
- v After successful payment, system will print out a waybill, and open a locker.
- vi Sender signs for waybill, paste it on the parcel and put into the locker.
- vii Close the locker, then system will notify express company to get these parcels.

Courier's operational procedures

- i Couriers come to get parcels.
- ii Confirm their identity with card.
- iii Choice receiving parcels button, couriers take away parcels.
- iv Check parcels (such as weight, whether it is dangerous to send).
- v Close the locker, then system will send a text message to senders to inform that parcels have been taken away.

2) Additional sending service

In most cases, senders may ask for express company to pack their parcels. So if they use delivery lockers, and put their parcels in the lockers and wait for couriers to pack, then there may be some problem during the packing process such as damage. Delivery lockers operators can provide self-packing service. This may be similar to vending machine, senders can choose boxes.

For senders whose parcels are very urgent to send, there can be an alternative for them. They can choose urgent parcel button and then couriers will come to get the parcel as soon as possible rather.

(7) Diversified services

Compared with delivery stations, delivery lockers only has single function, so there is no

great advantage. They can refer to Japanese delivery lockers business model, not just to provide parcels sending services, but also to add some convenient services, such as charging for electric vehicles, which can be combined with popular portable electric car charging stations, and increase profits. To provide some simple emergency medical devices such as cardiac pacemakers, some tools which normal families will not have, such as a wrench, pliers, and etc. To provide electricity, gas, and water fee payment. These services can be utilized by one card, and then these services will be more convenient.

7.3 Cooperating with express companies and reasonably charging

For charging problems, most customers will be scared off by overcharging, which leads to inefficient investment, while infinitely lowering charge will harm the benefits of investors. Therefore, making a survey about users' attitude to charging, to know users' accepted charging range about delivery lockers, this can help develop a mutually satisfactory charging method in the long term. From the survey results, the majority of respondents only accept charges of under 0.5 rmb, but from the perspective of economic benefit analysis, only charging over 0.7 rmb, then there will be considerable benefits. However, raising fees is not an effective and feasible method. In this regard, investors can refer to delivery stations' operating mode, which is, cooperating with express companies to reach long-term friendly relations of partnership. And they can directly undertake the delivery activities from express companies, so that delivery locker is becoming the last part of supply chain. It serves for express companies and takes percentages from express companies' benefits. This can help delivery lockers providers recover its investment and get paid back. With investigation, we know that some delivery lockers providers in other cities have established a friendly alliance with several major express companies, and own some stock in these express companies, so that they can further promote delivery lockers. As a result, they can lower their charges for users and attract more users, to improve coverage range of delivery lockers services.

7.4 Delivery lockers locations

(1) Promotion in residential areas

Currently, there are more than 4,000 residential areas in Nanjing, but only about 5% of them are equipped with delivery lockers. In the cases that many existing residential areas do not agree to invest delivery lockers, delivery lockers providers can negotiate with property developers when they just start designing the residential areas, so that the designers can add delivery lockers into the design blueprint, especially for some high level residential areas, setting up a delivery lockers room in the main gate is like an extra service provided by property developers.

After completion of this residential area, the house purchase fee will include the costs of delivery lockers, so it can avoid conflicts from additional property charges, and at the same time provides residents with a caring and thoughtful service, ensures the safety in this residential area, also improves service quality of this residential area, and attracts customers to purchase houses.

For some existing residential areas, there are many cooperating methods between delivery locker providers and property management companies, which can be flexible. For example, property management companies can seek for opinions of residents. If most residents show recognition and understanding in delivery lockers, then an additional property charge will be acceptable on basis of free use of these lockers. If only a small number of residents agree to introduce these lockers, then it can be paid services for some residents. After knowing needs of residents, property management companies make investment in purchasing proper amount of delivery lockers and provide service for residents. About how to charge for these delivery lockers, it can be consulted with residents together to develop a reasonable plan. For example, there can be some fixed lockers rent by some residents who are in need of receiving parcels, like mail box. For these residents who seldom use the lockers, they can also use lockers for times charge.

(2) Increase delivery lockers in office buildings

Although from the results in the field investigation, many office building have set some delivery lockers, which account for about 20% of the total in Moge and Haoshenghuo. However, from the results of surveys, many respondents are more willing to put delivery lockers in the office. Since the boom of online shopping, express volume is greatly

increasing, in addition to the students, office workers become greater consumer groups. Especially the white-collar, they are very keen for online shopping, but they are not at home during the day, so it is not easy to pick up parcels. Therefore, increasing delivery lockers in office buildings, no doubt, is a good way to promote. Firstly, office buildings provide a closed sheltered environment for delivery lockers. Secondly, generally, office buildings have security guards, and they will not allow unfettered access to buildings, so for post-maintenance work, it can provided a guarantee.

(3) Supermarkets

In Nanjing, SF express company has cooperated with local supermarket chain SG, consumers can be send and receive parcels by SF express service in any supermarket chain SG. This is undoubted a potential competitor for delivery lockers. We found that in the US, Amazon has put delivery lockers in many supermarkets and grocery stores, which not only makes lockers' security assured, but also help increasing supermarket turnover when customers come to pick up parcels. It has played a win-win result.

For today, the number of supermarkets is almost the same as residential areas in Nanjing, almost every residential area is equipped with a supermarket, so cooperating with supermarkets, for promotion of delivery lockers, is of long-term value. Some supermarkets have its own lockers to store customers' belongs, so it is convenient for delivery lockers company to negotiate about delivery lockers. And these lockers are placed near residential area but not in residential areas, for property management companies, it can eliminate concerns about security risks and residential property, and also is convenient for residents to pick up their parcels.

(4) Subway stations

With the rapid development and popularization of delivery lockers, it will not only focus on picking up and sending parcels, but on more and more personalized services, such as lottery sale, meals ordering, online ordering and etc. It can be considered to set delivery lockers in subway stations, and this may be special services for recipients who are unwilling to expose their private information, like address.

7.5 Partnership

(1) Cooperating with e-commerce companies

Cooperation with e-commerce companies can effectively satisfy the delivery needs in the end of the supply chain, or provide fresh fruits, vegetables and foodstuff purchasing to meet the daily needs of the residents. Fresh fruits, vegetables and foodstuff can be delivered immediately by a neighborhood store. Residents can order and pay online by apps on cellphone, or use the intelligent information system in the delivery lockers, then order information will be sent to the e-commerce companies and its couriers will put the parcels into the lockers. Delivery lockers information system will send a text message to recipients informing of pickup codes. In addition, if this consumer market becomes mature in the future, e-commerce companies can build a small community warehouses near several communities, and store some usually-buying goods, so consumers can receive their orders as soon as possible. In this case, the delivery lockers will have the opportunity to further develop the most important and most convenient shopping platform for residential areas. Thus there is locally forming a community with closed logistics, information, and capital flow. It has the advantages of close to home, fast delivery, low logistics cost, and can provide inexpensive high-quality goods and services to the public.

(2) Cooperating with takeout websites

Takeout websites is newly emerging in the market in recent years, by which customers can order meals and get the takeout food in the designated location. In these residential areas we did field investigation, we can often saw delivery workers from takeout websites, similar to parcels delivery, and these delivery workers need to deliver door to door. And meal time is often in the same time period, so it usually takes many times for door to door delivery and thus delivering warm takeout food is difficult. So, there may be possible for delivery lockers to considering cooperating with these takeout websites. Improved delivery lockers can keep the takeout food warm, and the ordering process is similar to cooperation with e-commerce companies. Customers can order online, and when the takeout food is put in the lockers, system will send a text message to customers to pick up. Thus, this will help reducing labor

costs from takeout websites, guaranteeing food quality, and also contributing to promote both companies' business.

(3) Cooperating with universities

As we have mentioned above, management personnel in Haoshenghuo are aged and it lacks of innovative and advanced equipment, which is inferior to Moge. In this case, the most effective way is to cooperate with universities, forming a technical group to develop and research more intelligent delivery lockers to handle with competition from other companies.

7.6 Seriously dealing with customer complaints

In the previous chapter, as we mentioned, these two delivery lockers providers we surveyed in Nanjing both have an unsatisfactory performance in handling with customer complaints. From the data in terms of the customer complaints, for these two delivery lockers providers, customers are both more satisfied about complaint handling process and complaint handling time than complaint handling results. Referring to a lot of literature, we found that willingness to repurchase is positively related to its customer satisfaction degree of complaint handling, which means that customer satisfaction degree of complaint handling will affect customer loyalty, thus affecting the economic benefits of the company. Suggestions we give here is, that when consumers are not satisfied with the complaint handling results, a compensation made by companies helps dealing with customer satisfaction degree, study found this helps improving customer satisfaction with complaint handling process.

Comprehensively speaking, an important process for handling complaints usually has the following four steps.

(1) Identifying themselves

When handling complaints, showing identification is aimed to produce a sense of trust, and make customers willing to believe that you can handle the problem. The process of handling complaints for customers is a subtle psychological process, people in high position makes

customers feel that this company is very concerned about their complaints, and feel respected, which thus contributes to solve the problem.

(2) Carefully listening and recording

Attitude of listening and recording can quickly meet customer desire of being respected. Accordingly, in the process of handling complaints, people in charge of handling complaints must keep eye contact with customers and smile, so that the customers will feel goodness from the company. If it is telephone complaints, people in charge of handling complaints must be gentle and patient.

(3) Sincerely apologizing

It plays a key role. Apologize just indicates an attitude of respecting customers, and is not related to complaint itself. In most cases, an apology can help smoothing the process of complaints handling.

(4) Reacting quickly and compensating the loss of customers

Complaints handling should be fast and if customers suffered from losses, they should take prompt measures to compensate.

7.7 Establishing good corporate image

Companies should develop a corporate logo, which is of their own distinct characteristics, and can impress the public by its impressed name, slogan, logo color, vehicles, and advertisements. In addition, adding "delivery lockers" word into its slogan can relate company's name with delivery lockers, which makes customers first think of this company, when it comes with delivery lockers. All these plans to arouse public attention make the public unconsciously accepting their delivery lockers. For example, branding of Moge represents advanced intelligent, more personalized delivery lockers, while Haoshenghuo is cheap and convenient. In addition, participating in public welfare activities is also considered as a business with a strong sense of social responsibility by the public.

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Appendix 1

Part I

Delivery Lockers Questionnaire

Hello, we are conducting a survey of delivery lockers using, and hope you could spend a few minutes to fulfill this questionnaire. This questionnaire is anonymous; all data will be only used for statistical analysis. There is no right or wrong for each question, please fill out according to your actual situation. Thank you for your help!

1. Your gender: A. Male B. Female

2. Your age:

- A. 18-25 years old
- B. 25-35 years old
- C. 35-45 years old
- D. 45-55 years old
- E. Over 55 years old

3. Your month salary:

- A. Under 2000 RMB
- B. 2000-3000 RMB
- C. 3000-5000 RMB
- D. Over 5000 RMB

4. How often do you do online shopping?

- A. Frequently, every week
- B. Often, several times in one month
- C. Sometimes
- D. Seldom
- E. Never

5. How do you usually pick up your parcels?

- A. Door to door
- B. Designated place in the residential area, working place or college town

C. Delivery lockers

D. Other place

6. How does delivery lockers impress you?

A. Very useful

B. Useful

C. Not bad

D. A little bad

E. Very bad, could you tell the reasons

7. Which delivery lockers do you use?

A. Moge company

B. Haoshenghuo company

8. Can you accept the charges for delivery lockers?

A. Very fair

B. Fair

C. Not bad

D. Unacceptable

E. Very unacceptable

F. Haven't used it so have no idea about it

9. Are you satisfied with the present charges for delivery lockers?

A. Very satisfied

B. Satisfied

C. Not bad

D. Unsatisfied

E. Very unsatisfied

F. Haven't used it so have no idea about it

10. Is there information error with delivery lockers? Such as wrong locker number and wrong pickup code.

A. Frequently, every week

B. Often, several times in one month

- C. Sometimes
- D. Seldom
- E. Never
- F. Haven't used it

11. Will the company quickly respond to your request when there is information error or parcel delivery problems?

- A. Very quickly
- B. Quickly
- C. Not bad
- D. Slowly
- E. Very slowly
- F. Haven't get a problem like that
- G. Haven't used it

12. Fulfill a circle for your choice.

	Strong Yes	Yes	Whatever	No	Strong No	Haven't use it
Will you reuse delivery lockers ?						
Will you recommend it to others ?						
Will you use it in the long run ?						

13. Where do you want to put these delivery lockers? (Multiple choice)

- A. Residential area
- B. School
- C. Office Building
- D. Subway or bus station
- E. Shopping mall

F. Restaurant

F. Entertainment place

G. Others

14. Do you have other advices for delivery lockers?

Thank you for your help! Have a nice day!

Part II

Telephone interview with complaints customers

(1 Very satisfied 2 Satisfied 3 Not bad 4 Not satisfied 5 Super unsatisfied)

1. Are you satisfied with your complaint handling process?
2. Are you satisfied with your complaint handling time?
3. Are you satisfied with your complaint handling results?

Part III

Person interview

1. Do your delivery lockers have some advantages than other companies ?
2. How is the parcel damage rate of your delivery lockers ?
3. How is the delivery rate of your delivery lockers ? How do you track them ?
4. Do you have some personalized services ?
5. Do your delivery lockers have some countermeasures to disaster or accidents, such as fire ?
6. Do you have value-added services ?
7. How many staff in your company ? How is the educational level of your staff ? Are they effective for their work ?
8. What are the costs of a delivery lockers, such as manufacturing costs, power consumption, maintenance costs, employee salary ? How many years can these delivery lockers use for ?
9. Have you already extended your delivery lockers business, and what is that ?

Appendix 2

Customer satisfaction indicator weight survey

Hello, we are conducting a survey about customer satisfaction and hope you could spend a few minutes to fulfill this questionnaire. This questionnaire is anonymous, all data will be only used for statistical analysis. There is no right or wrong for each question, please fill out according to your actual situation. Thank you for your help!

Importance degree indicator	Implication
1	Compared with A_i and A_j , they have equal importance
3	Compared with A_i and A_j , A_i has weak importance
5	Compared with A_i and A_j , A_i has essential importance
7	Compared with A_i and A_j , A_i has very strong importance
9	Compared with A_i and A_j , A_i has absolute importance
2,4,6,8	Intermediate values between numbers above
Reciprocal	If a_{ij} is importance degree ratio between A_i and A_j , then importance degree ratio between A_j and A_i is $a_{ji}=1/a_{ij}$

Table: Importance degree indicator and its implication

Customer satisfaction

For customer satisfaction, compared with these factors in pairs, which one do you think is more important and to what extent it is important than another?

	Corporate Image	Service quality	Service Price	Customer complaints	Customer loyalty
Corporate Image	1				
Service quality		1			
Service Price			1		
Customer complaints				1	
Customer loyalty					1

Corporate image

For corporate image, compared with these factors in pairs, which one do you think is more important and to what extent it is important than another?

	Advanced equipment	Public image
Advanced equipment	1	
Public image		1

Service quality

For service quality, compared with these factors in pairs, which one do you think is more important and to what extent it is important than another?

	Information accuracy	Delivery delay rate	Parcel damage rate	Tracking ability	Personalized service	Value-added service	Ability to handle disaster and accidents	Response	Education
Information accuracy	1								
Delivery delay rate		1							
Parcel damage rate			1						
Tracking ability				1					
Personalized service					1				
Value-added service						1			
Ability to handle disaster and accidents							1		
Response								1	
Education									1

Service price

For service quality, compared with these factors in pairs, which one do you think is more important and to what extent it is important than another?

	Price acceptance	Price satisfaction	Rivals competition
Price acceptance	1		
Price satisfaction		1	
Rivals competition			1

Customer complaints

For customer complaints, compared with these factors in pairs, which one do you think is more important and to what extent it is important than another?

	Satisfaction for complaint handling process	Satisfaction for complaint handling time	Satisfaction for complaint handling results
Satisfaction for complaint handling process	1		
Satisfaction for complaint handling time		1	
Satisfaction for complaint handling results			1

Customer loyalty

For customer loyalty, compared with these factors in pairs, which one do you think is more important and to what extent it is important than another?

	Reuse possibility	Recommendation possibility	Long-run use possibility
Reuse possibility	1		
Recommendation possibility		1	
Long-run use possibility			1

Thank you for your help! Have a nice day!