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WORLD MARITIME UNIVERSITY

Shanghai, China



**CUSTOMER VALUE EVALUATION IN X
LOGISTICS ENTERPRISE**

By

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China

A research paper submitted to the World Maritime University in partial fulfillments of
the requirements for the award the degree of

MASTER OF SCIENCE

ITL

2012

Declaration

I certify that all the material in this research paper that is not my own work has been identified, and that no materials are included for which a degree has previously been conferred on me.

The contents of this research paper reflect my own personal views, and are not necessarily endorsed by the University.

2012-06-08

Supervised by
Professor Qu Linchi
World Maritime University

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Abstracts

Title of Research paper: Customer Value Evaluation in X Logistics
Enterprise

Degree: MSC

With the development of modern science technology and economic globalization process, the competition of the logistics industry is getting more intense. Third-party logistics firms must carry out different management towards different customer groups to improve customer satisfaction and loyalty. How can the third-party logistics enterprises identify the customer value? It is the issue will be discussed in this paper. After summarizing of the research status at home and aboard, this paper presents understanding of customer relationship management and customer value theory. The article introduces a number of customer segmentation models with brief concluding of customer value evaluation methods that are commonly implemented in practice especially the Analytic Hierarchy Process model.

Based on the operating characteristics of third-party logistics enterprises, this paper researches on elements effecting customer value by means of the analysis of customer value factors and proposes a specific evaluation system of customer value aiming at third-party logistics enterprises in order to deal with certain problems of customer segmentation and discriminatory.

Finally, in view of the particular circumstance of X logistics company, the paper applies the built system to achieve the certain customer value and to analyze the direction of future customer management strategy.

This research work can roughly help the third-party logistics enterprises properly identify customers with high value. It assists the enterprises to gain better customer relationship, ultimately achieving the value maximization of the enterprises as well as the development of the industry.

Key words: third-party logistics, customer value, AHP, cluster analysis

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List of Abbreviations

3PL	Third-party Logistics
CRM	Customer Relationship Management
CLV	Customer Lifetime Value
VIP	Very Important Person
RFM	Regency, Frequency, Monetary
ABC	Activity-Based Costing
CLP	Customer Lifetime Profit
AHP	Analytic Hierarchy Process

Chapter 1 Introduction

1.1 Purpose and Significance of Research

1.1.1 Research background

A third-party logistics provider is a firm that manages, controls and provides logistics services operating for external customers by offering a complete set of logistics activities to serve the product supply chain. The driving force of development of third-party logistics is to create profits for customers and itself, which requires the enterprises to meet customers' needs and expectations by attractive service. Customers are seen as the most important asset for third-party logistics enterprises, being the entrance of the transaction and cash inflow. With the increasingly fierce market competition, third-party logistics enterprises must carry out different management strategy on different customers to maintain their advantage and to enhance customers' satisfaction and loyalty.

X logistics company has set up 34 branch offices, 385 operations and warehouses of 150,000 square meter-area. It has established its own logistics distribution network system and developed its own logistics information system. With the introduction of three logistics zones, X logistics company has attracted more and more peers to participate in its operation. Through the recent development, X logistics company has transformed into a modern comprehensive logistic enterprise gathering transportation, distribution, warehousing, packaging, processing and information services. The future developing direction of X logistics company is to become a provider of logistics integration solutions.

At the moment, X logistics company is adopting pyramid method for customer segmentation, which only takes the customer current value into consideration. Thus, the index evaluation system with comprehensive analysis of various factors assigned

in this article will be a powerful solution to the customer classification problem of the company.

1.1.2 Research purpose

In order to realize the differentiated customer administration in third-party logistics enterprises, customer value should be evaluated. The evaluation includes the present value, such as supplied efficiency, profit, and also the potential value, such as business expanding scope. At present, third-party logistics enterprises do not have clear and reasonable evaluation methods of customer value and principles of customer classification but only label their customers by sales rank, which is not a targeted scientific management strategy. Reasonable evaluation of the customer helps to effectively allocate scarce resources, strengthen ties with customers and obtain real competitive advantages. The ability of identifying and maintaining these valuable customers as well as cultivating their loyalty determines the competitive advantage of third-party logistics enterprises. Thus, the study on customer management and evaluation system in this paper is necessary.

1.2 Correlational Studies

Customers are the most important asset for enterprises. The information supporting system must be developed due to the requirements of the customer information autonomy. Customer relationship management (CRM) is a broadly executed strategy for managing a company's interactions with customers, clients and sales prospects, raised by Garter Group. It involves using technology to obtaining, maintaining and increase profitable clients. CRM helps enterprises reduce the costs of marketing and customer service through customer segmentation and specific aiming strategy. Customer relationship management describes a company-wide business strategy including customer-interface departments as well as other departments. It is crucial to

estimate customer value for customer relationship management.

Customer evaluation is the basis of implementation of differentiated services, which assesses customer value and classifies customer. The study of customer evaluation is divided mainly into two aspects named as customer value theory and customer classification method

Customer value contains two levels: considering customer as the perception subject as well as the enterprise as the perception subject. The customer value study under the enterprise angle contains customer value research and customer lifetime value research.

In order to get a detailed understanding of customer value, J. C. Hoekstra and J. Kim proposed that the customer value should be divided into current value and potential value, containing up-buying and cross buying.

The study on CRM, at home and abroad, is divided mainly in three areas: First, study of consumers, mainly related to individual characteristics, demand characteristics, as well as psychology, behavioral status of consumers; Study of communication, mainly related to the customer communication from the marketing point; Study of software system, mainly contains the research on CRM software applications on the level of e-business.

Shaw. R and Stone. M raised the concept of customer lifetime value in Database Marketing. It represents in theory exactly how much each customer is worth in monetary terms, and therefore exactly how much a marketing department should be willing to spend to acquire each customer.

Maslow's hierarchy of needs is a theory in psychology, proposed by Abraham Maslow in his 1943 paper A Theory of Human Motivation. It is often expressed by a pyramid shape model, with the largest and most fundamental levels of needs at the bottom, and the need for self-actualization at the top. The most fundamental and basic four layers of the pyramid contain what Maslow called "deficiency needs": esteem, friendship and love, security, and physical needs. It is suggested that the fundamental level of needs ought to be fulfilled before the higher level needs are intensely desired.

James L.Hesketts,Thomas O.Jones and Gary W loveman studied on the relationship between the customers' satisfaction and loyalty. Although customer satisfaction and customer loyalty shows different relationship curve according to different competition level in different industry, one thing in common is that they are positively correlated.

Daniel Charmi chael used funnel theory as a vivid metaphor of companies' behavior towards customers. In order to keep the original turnover, companies have to continue injecting new customers from the top of the barrel to compensate the loss part, which is an expensive and endless process.

Snuil Gupta defined the existing customer value, pointing out that customer value contains the future customers gained by the current activities. He also established the dynamic model of customer lifetime value.

With the gradual rise of marketing, people began to concern for research on consumer psychology, behavioral status from the marketing perspective. Venkatesan and Kumar considered customer lifetime value as a measurement criterion of customer choosing, because the profits created by selecting customers based on the customer lifetime value appears to be higher than those based on other methods.

Chen Mingliang, Qi Jiayin and many other scholars have worked on the customer lifetime value and gained representative achievements on the calculation models.

Customer value research mainly focus on the evaluation model of customer value and customer segmentation method, while customer value model is mainly concentrated on the calculation of customer revenue streams. As to customer segmentation and reservations based on customer value, researchers raised analytic hierarchy process to study the existing customer information and predict future customer transactions. The research on evaluation index system of customer value is vague. In fact, due to the different types of customers, the influencing factors of customer value differ, so does the customer value index system.

1.3 The Framework

In this paper the structural system shows as follows:

Chapter 1 introduces the purpose of this study and significance of domestic and international study status of customer value and the main contents of this article.

Chapter 2 mainly introduces the definition and connotation of customer relationship management and customer value, and also reviews methods of customer segmentation and value evaluation.

Chapter 3 raises various characteristics of third-party logistics enterprises and the necessity of customer value evaluation in the industry.

Chapter 4 establishes the specific customer value evaluation system of third-party logistics enterprises through the operating characters, and classifies customers through cluster analysis.

Chapter 5 applies the evaluation system in the specific company to compare with the original classification method and presents the suggestion of customer management.

Chapter 6 summarizes the research results of this paper and proposed the inadequacies of the study.

Chapter 2 Customer Segmentation and Value Evaluation

2.1 Customer Segmentation

Different customers create different value for companies. Through customer segmentation, the model classifies customers into different types and gives different management strategies to meet their needs. Most customer segmentation refers to divide the existing customers into different customer base in accordance with certain criteria, when the customers in same group share similar characteristics.

Current customer value segmentation model is divided into the following categories:

(1) Pyramid customer segmentation model

The customers are piled from small to large according to their contribution to the enterprise. Those who create profits and value of the largest amount lie at the top, while those who create little profit and value are located in the bottom, so that we can get a pyramid model.

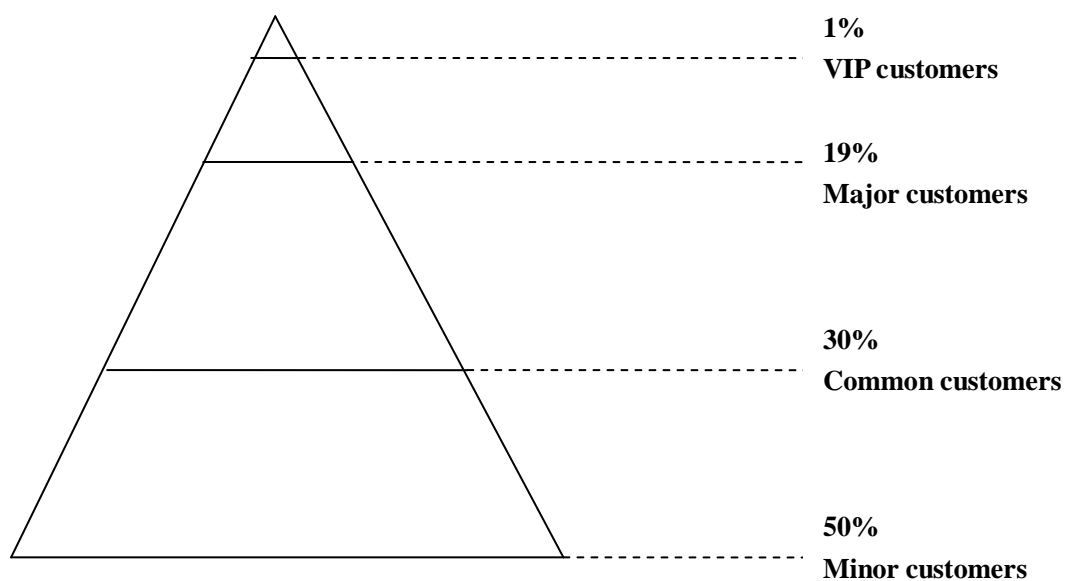


Figure 1 Pyramid Customer Segmentation Model

Customers are divided into four levels of hierarchy in the model: VIP customers, major customers, common customers and minor customers.

VIP customers cover 1% of the total amount, bringing the greatest value to the enterprise. They are the most loyal and stable part of the enterprises' client assets, since they create the vast majority of long-term profits. They are not price sensitive, and are also very willing to trial new products or services provided by the enterprise. Usually their total business volume is increasing, and there is still a large potential to be tapped in incremental sales or cross-selling in the future, when companies only need to pay for a lower cost of services to maintain the good relationship.

Major customers are located in the second level of customer pyramid. They represent the other top 19% of customers contribute the greatest value to the enterprise excluding VIP customers. Compared to VIP customers, they are more sensitive to price as well as less loyal. They are likely to maintain long-term relationship with many enterprises at the same time in order to reduce risk.

VIP customers and major customers, usually accounting for 20% of the total number of corporate customers, constitute the key customers of the enterprise. 80 percent of the corporate profits depend on their contribution. They can be said to be the key protection and source of profit of the company.

Common customers in the third layer of the pyramid customers generally hold 30% of the total number of customers. Common customers contain large number of customers, but the potential value of their purchasing power and loyalty is far smaller than the VIP and major customers, and are not worthy of special treatment.

Minor customers including both low-profit customers and low-quality customers of lower credit, taking the bottom of the pyramid, account for 50% of the customers.

(2) RFM customer segmentation model

Marcus constructed the customer value segmentation model by means of consumption frequency and average consumption amount according to RFM model. "R(Regency)" is the time that has elapsed since the customer made his most recent purchase. A

customer who made his most recent purchase last month will receive a higher recency score than a customer who made his most recent purchase three years ago; “F(Frequency)” is the total number of purchases that a customer has made within a designated period of time. A customer who made six purchases in the last three years would receive a higher frequency score than a customer who made one purchase in the last three years; “M(Monetary)” is each customer's average purchase amount.

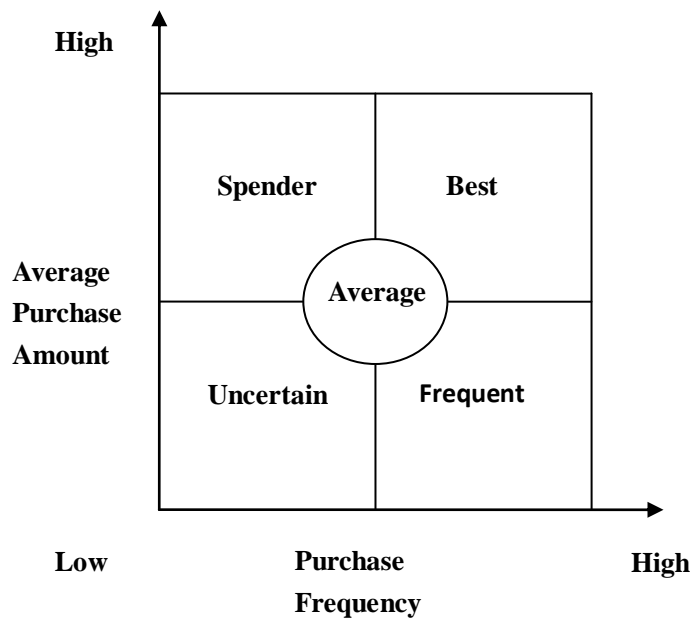


Figure 2 RFM Model

Enterprises effort to retain best customers because they are the largest source of profits as well as the foundation of the development.

As for spender type and frequent type, enterprises should try to enhance the frequency through up-buying and cross buying since they provide motive power for the development and expansion.

Enterprises should be capable of finding out the valuable ones among uncertain customers and flexibly transfer them into superior ones.

2.2 The Value Theory of CRM

Customer relationship management from the new "customer-centric" business model is developed on the basis of improving business and customer relations. CRM improve customer satisfaction and loyalty, in order to improve customer retention.

CRM is a management philosophy: the customer is the most important resource.

CRM is a management mechanism: the implementation of this new management mechanism allows customers to enjoy high-quality services in the business of marketing, sales, service and technical support and customer-related areas, While expanding the sales and reduce operating costs of enterprises.

CRM is a management software and technology: It integrates internet and e-commerce, multimedia technology, Data warehouse and data mining, expert systems and artificial intelligence, call center, the latest information technology.

As one of the goals of the customer relationship management, retention and development of customers does not mean that all customers are worth to spend resources to reservations, but requires enterprises to create more value for the enterprise according to the demand for the limited resources into customers up. In this regard, customer value analysis is one of effective methods to help companies identify valuable customers.

Research on customer value in three perspectives: customer perspective, business perspective and customer-enterprises perspective.

(1) The customer perspective of customer value

It refers to the product or service perceived by customers in the consumption process brings their own value.

(2) The enterprises perspective of customer value

This perspective focus on customers that bring value to the enterprise, mainly to measure the relative importance of different customers for the enterprise, identify high and low value customers, and a reasonable allocation of resources, enterprises with limited resources can be fully utilized.

(3) The customer-enterprise perspective of customer value

This perspective is the value of the exchange process consumers and businesses, customer and business needs in this process not transactions, and will form a number of other economic and non economic relations.

This study is the Enterprises Perspective of customer value, referred to following papers have indicated value of feelings are the main enterprises, value feel the object is customer's value.

2.3 Customer Value Evaluation Method

Calculation and evaluation customer value can be considered separately from two angles direct calculation and indicators for evaluation. Direct calculation achieves specific values of customer value through strict mathematical calculation; while index evaluation indirectly achieves evaluation of the index value through relevant indicators.

2.3.1 Direct calculation

Direct calculation of customer value is to calculate the actual net profit of customers in evaluation stage and predict customer monetary value of the remaining life cycle.

Direct calculation of customer value has the following findings:

(1) Wayland-Cole, purchase probability models

This model stems from research to retain customer loyalty and customer. Wayland and Cole combined customers' future purchase of uncertainty, the introduction of customers to buy probability factor, build customer value analysis model under conditions customer purchase probability.

$$V = \sum_{t=1}^n P_t(Q_t \pi_t)(1+i)^{-t} - \sum_{t=1}^n (D_t + R_t)(1+i)^{-t} - A \quad (2-1)$$

In the formula: V stands for customer value Q stands for purchase quantity at t time. π_t stands for unit profit at t time. C stands for cost at t time. P_t stands for the probability of purchase at t time. D stands for the development cost of customer relationship at t time. R_t stands for customer retention cost at t time. A stands for first time to build relationships customer acquisition costs and i stands for discount factor

(2) Activity-Based Costing

Activity-Based Costing calculates customers cost based on the number of business activities customers consumed. ABC cost method believes: corporation activities are in fact used to support production, marketing, products and services. Therefore support costs can be reasonably allocated to a single product / customer, then using the following formula to calculate customer value.

Customer value = Income - Acquisition costs - Cost of sales - Cost of service - Maintaining costs

ABC cost method can calculate customer's history profit, but can not forecast customer's future value. Although it is theoretically applicable to many industries, but profit calculation process is very complex. Therefore, this method requires that companies must have an activity-based accounting system and data.

(3) CLP fitting function method

The principle is: predicting future profit model, based on customer history of profit and known typical customer profitability curve fitting, and then according this mode of the mathematical functions predict the CLP.

2.3.2 Index evaluation

Index evaluation is indirect customer value evaluation by means of related indicators

since direct calculation of customer value has a certain degree of difficulty currently. The index evaluation can provide an effective way for enterprises to understand the customer, on which has obtained research achievements shows as follow:

(1) RFM model

The model assesses customer value according to consumption interval, consumption frequency and amount of consumption. A customer who averages a \$100 purchase amount would receive a higher monetary score than a customer who averages a \$20 purchase amount (average purchase amount = total dollars spent on purchases in last three years / total number of purchases in last three years). The RFM model has a fixed and simple operation procedure, and it is the most commonly used method among all the existing CRM software. RFM model is a data mining approach developing from direct selling industry, therefore, the applicability is not strong while used in other industries outside of direct selling industry.

(2) Qi Jiayin model

Professor Qi Jiayin represents customer value through two primary index and six secondary index including gross profit, purchases, service costs, loyalty, trust and credit. The gross profit index reports the price level customer actually paid. Purchases index indirectly reflects the differences of the customers in cost-sharing. Cost of service visually displays the difference of service inputs that company treats different customer. Gross profit, purchases and service costs constitute the customer's current value while the other three form the potential value. Professor Qi believes that customer loyalty is a procedure of forming, strengthening, stabilizing and declining which can be used to evaluate the change of customer potential value in the future.

2.4 Customer Evaluation Method Based on Index System

2.4.1 Analytic Hierarchy Process

Analytic Hierarchy Process (AHP) was raised by Thomas L. Saaty, based on mathematics and psychology. AHP helps to discover the target fits most with consciousness of the issue. It offers a frame work structure to deal with the issue with comprehensiveness and rationality, to relate the factors to total targets, and to evaluate alternatives. The first layer of AHP can be decomposed into sub-problems which are easier to understand, each of which can be analyzed independently.

2.4.2 Fuzzy Analytic Hierarchy Process

The Analytic Hierarchy Process mentioned above does not take the ambiguity of human judgment into account. Therefore, Fuzzy Analytic Hierarchy Process has been developed through the procedure of applying Analytic Hierarchy Process to the fuzzy environment. Adopting Fuzzy Analytic Hierarchy Process during the multi-objective decision-making is able to avoid possible problems that may occur when using Analytic Hierarchy Process.

Chapter 3 CRM of Third-party Logistics Enterprises

3.1 Operating Characteristics of Third-party Logistics Enterprises

3.1.1 The basic characteristics of 3PLs

The main function of 3PLs is providing customers with specialized service of adding value to tangible products through service and gain profit at the same time. The quality of the 3PLs' products equals the quality of service.

Third-party logistics enterprises are external suppliers providing companies with all or part of the logistics services, generally including transportation, warehousing management, distribution and so on. During the process, third-party logistics suppliers are not producers or sales, but a third party servicing in the entire logistics procedure from production to sales, which normally does not own goods, but provide customers with logistics services. 3PLs have their own characteristics listed as follow:

(1) Contract-based logistics service

Unlike traditional outsourcing which is restricted to only one or a number of dispersive logistics functions, 3PLs tend to offer logistics services of multi-functional, or even more, the entire extent, under the terms of the contract requirements instead of present need.

(2) Personalized logistics service

3PLs generally serve only one or a small number of targets for a longer period, which is different from public logistics services, since the demand side requires different business processes. Logistics and information flow change with the value flow, and

thus the 3PLs' services is required to customize the customers in accordance with their business processes.

(3) Electronics and information technology based

The development of information technology is a necessary condition for the appearance of 3PLs. Information technology achieves fast, accurate data transfer and the level of automation of warehouse management, handling, transportation, procurement, ordering, shipping, distribution and order processing. Companies can communicate and collaborate with logistics enterprises more easily by information technology so that the coordination and cooperation between enterprises may be quickly completed in a short period of time. At the same time, with the rapid development of computer software, the business costs mixed among other logistics activities can be accurately calculated, which makes it possible for the enterprises to deliver jobs previously done in-house to the logistics companies.

(4) Strategic alliance

Relying on the support of modern electronic information technology, enterprise share information fully, which requires both sides to trust each other in order to achieve better results than individually engaged in logistics activities. They share risk and revenue considering from the charging principles of logistics service providers. Furthermore, the association between enterprises is not only one or two market transactions. They only form a considerable advantage and risk-sharing organization in the middle of logistics flow.

3.1.2 Revenue and costs of 3PLs

Third-party logistics is a business model providing logistics services for logistics companies except both supply and demand side. Professional logistics companies provide all or part of the logistics services within a certain period in the

form of the contract in the logistics channel.

The profit of 3PLs does not come from direct costs such as freight, storage charges and other income, but from the new value produced by the promotion of modern logistics management science.

According to statistics, China's 3PLs service providers gain 85% of their revenue from basic services such as transportation management and warehouse management, while the part of logistics information services and other supporting industries accounted for only 15%. Sample survey conducted among 3PLs in Hangzhou, Shanghai and other cities, their profit pool can be simply divided into the following four categories: freight forwarders, transport and storage, management consulting and supply chain management.

3.2 The Necessity of CRM in Third-party Logistics Enterprises

More and more companies tend to hand over logistics activities to an independent logistics service company, so that the company's logistics function can be externalized. Logistics is turning from activities into service or even commodities. The main function of CRM in 3PLs contains:

(1) Gaining the customer satisfaction and attracting more customers

3PLs are able to provide customers with one-to-many interactive services by CRM. Customer loyalty can be discriminated through the analysis of service applied frequency and persistent. Through the detailed transaction data, the enterprises are able to identify those attractive customers who bring high profit and make sure that they can enjoy first-class service. As a third party between the suppliers and manufacturing companies or retailers, it is possible to seize the potential customers through the business dealings with any party in order to win more customers.

(2) Segmenting customer groups and developing the intermediary business

As the intermediary of the social transactions, 3PLs have storage of a large number of

customer transaction information and the information of suppliers, manufacturers and retailers at the same time. 3PLs together with suppliers, in the grasp of consumer demand, develop the intermediary business so as to better serve the customers.

(3) Analyzing crisis and avoiding risks

There are relatively less customers for 3PLs, so that they are able to identify whether the customers are preparing to transfer to other logistics companies through specific analysis of each customer. Discovering the gap between themselves and other enterprises in time and adjusting accordingly will be useful to retain customers.

Chapter 4 Customer Value Evaluation of Third-party Logistics Enterprises

4.1 The Objective of Evaluation System

Corporate utility in the short-term performs on two aspects of economic utility and non-economic utility. The economic utility refers to the current economic benefits, primarily for profit, while non-economic utility mainly refers to the relationship between the effectiveness of customer trust, loyalty, commitment and other factors. Although the relationship utility can not be cashed in recent economic gains, but it can greatly enhance the company's future earnings potential, and it is an inexhaustible motive force of sustainable competitive. From the perspective of long-term development, the necessary condition for the existence of non-economic utility is the economic utility accompanied. Its economic utility is often huge, but very difficult to be precise quantified. Short-term economic effectiveness and long-term economic utility need to be taken into account through the business process in order to achieve the objective of the overall economic utility optimization.

Customer-centric business philosophy not only did not weaken the economic utility maximization of the enterprise, but also reinforced the standard to some extent. With the increasing of commodities options and the improving of information asymmetry, the trading patterns characterized by “selling” has been gradually replacing by a win-win alliance mode characterized by “relationship”. Although the operation strategy has changed in the market environment, the operation philosophy of economic utility maximization has not been happened any slight change. On the contrary, the strategic adjustments made under the new

economic environment have precisely contributed to such changes.

Under the premise of profits, enterprises adopt customer-centric marketing approach to provide customers with value-added services and satisfy customers of long-term interest. The relationship between enterprises and their customers must ensure that the benefit is greater than the cost. Customer relationship management helps to achieve the purpose of maximizing enterprise economic utility through identifying, retaining and developing the value of customers.

With the fiercer competition of third-party logistics enterprises, the driving force of development is to create profits for customers and itself, which requires the enterprises to meet customers' needs and expectations by attractive service. Customers are seen as the most important asset for third-party logistics enterprises, being the entrance of the transaction and cash inflow. The core of achievement is to value different customers and use it as a basis to achieve a personalized customer service.

A customer value evaluation system will be designed in this paper to evaluate customer contributions and to provide them with personalized service, to eventually achieve the win-win situation of economic utility between enterprises and customers.

4.2 Principles of Designing

According to the type of the selected customer value assessment system, each evaluation index should be specifically chosen. The evaluation index must facilitate assignment and calculation in order to reflect the the 3PLs customer value scientifically and rationally. When establishing the evaluation index system, the following principles should be obeyed:

(1) Integrity

The correlation and integrity between various factors should be taken into account when selecting the evaluation index, so that the system can be structured reasonably on number of indicators.

(2) Comparability

Each of the evaluation should be comparable towards different customers in order to make a distinction between customers.

(3) Relative independence

The relevance of the indicators should be as small as possible.

(4) Dynamics

The evaluation should reflect the dynamic changes in customers' future value as accurate as possible. Customer relationships are long-term projects, requiring customers to have a continuing value.

(5) Significance

The index should be closely associated with the target to make factors that have great impact on the evaluation result prominent.

(6) Metrizability

The data and information should be easy to get from the enterprise to ease the measurement and definition.

4.3 Designing of 3PLs Customer Value Evaluation System

On the basis of the six principles above, an initial customer evaluation system will be built in this section in consideration of the operation characteristics and payments of 3PLs.

4.3.1 Index choosing

The index are screened from the two dimensions of the customer's current value and potential value, and finalize the evaluation index of the third-party logistics customer value. The discrimination of customers' current value is combined with warehousing and transport functions of 3PLs. Identified indicators include three, namely the storage index, the transportation index and the cost index. The potential value of customers is determined as customer loyalty indicators and customer growth

indicators, each of which can be subdivided into multiple sub-indicators. The following section will give a detailed description of the various selected index in this system:

(1) The index selection of customers' current value

The customer's current value mainly deals with the contribution to the enterprise occurred through the purchase of their service according to the characteristics of third-party logistics industry.

① Storage index

a. Leased area

Leased area reflects the size of the warehouse that customers leased in third-party logistics companies. Usually customers leasing larger space are more important to companies.

b. Inbound and outbound total amount

Warehouse operations mainly include inbound and outbound of goods. The total amount illustrates the amount of the warehousing operations of a customer. The greater the amount of inbound and outbound, the larger the size of the client, so the profits and benefits generated will also be larger.

c. Inbound and outbound number of times

The number of inbound and outbound shows the frequency of customers' business, and it is also a reflection of the goods turnover speed. Furthermore, associated costs gets higher when there are more times of turnover, so that the total profit will increase accordingly.

② Transportation index

a. Number of delivered customers

The number of delivered customers is the number of the transportation and distribution locations, which actually reflects the scope and volume of the usual transport and distribution business. Customers with more delivery locations generally own a bigger business scope and bring greater profits to the company.

b. Delivery amount

The delivery amount reflects the level of customers' transport distribution business. Customers gain more importance when they own greater number of transportation and distribution services.

c. Delivery number of times

The delivery number of times equals the frequency of occurrence of clients transportation and distribution business. The associated costs increase with the growth of the number of transportation and distribution business.

③ Cost index

a. Average logistics costs settlement period

In accordance with the working experience in the practice of third-party logistics enterprises, customers with better credit can settle accounts on time. The shorter the settlement period lasts, the more favorable it is for the turnover of the company's funds, while the cycle's long lasting will result in pressure on the company's working capital.

b. Historical transactions

History transactions mostly include whether there is arrears and the possibility of return. Customers with good reputation generally do not default fees.

(2) The index selection of customers' potential value

The remaining length of the life cycle of the customer is one of the determinants of the customers' potential value of third-party logistics enterprise, and it can be decided by customer loyalty. A higher level of customer loyalty and a longer customer life cycle lead to greater profit and higher rate of return on investment for company, which indicates that the customer loyalty can be treated indirectly as an important indicator of the assessment of customers' potential value. At the same time, up-buying and cross buying can be reflected by customer growth, which is both the value customers can develop and the possibility of purchase. The customers' potential value will be showed in two sections named customer loyalty and customer growth in this article, with individual sub-indicators as follows:

① Customer loyalty index

Customer loyalty in the business environment is defined as the continuity and consistency showed when a third-party logistics enterprise customer is enjoying the consumer behavior of logistics services. It can be broken down into three types of behavioral loyalty, sense of loyalty and emotional loyalty. Combined with the special nature of the third-party logistics industry, customer loyalty can be reflected by the following five sub-indicators:

c. Testimonials

It is the reflection of customers' sense of loyalty. A customer owns higher loyalty when he speaks highly of the service quality. This kind of evaluation contains the perception of service quality offered by the 3PLs, including storage and transportation.

d. Customer relationship

A good customer relationship is proportional to customer loyalty and trust. For example, the customer loyalty becomes the highest when customers and third-party logistics enterprises belong to strategic alliance partners or complementary relationship.

e. Customer relationship set-up time

It is the embodiment of whether the customer is purchasing the service continuously. A longer period of the continuous transaction reflects the customers' behavior loyalty. As proved in practice, customers who have set up a longer relationship with the company will be much less affected by other market factors.

f. Price sensitivity

Customers with a lower price sensitivity coefficient enjoy higher loyalty, and they make greater contribution to premium.

g. Switching cost

The one-time cost occurring when changing a third-party logistics supplier to another reflects customers' option range and market competition degree. If the customer is facing with a higher switching cost, he would be more loyal.

② Customer growth index

Third-party logistics enterprises need to consider two aspects of customer growth: one is the possibility of up-buying and cross buying and the other is profit brought with the purchase possibility. Therefore, customer growth index contains four factors:

h. Business growing rate

It means the growing condition of the business amount that customer has used, which directly shows the possibility of the up-buying.

i. Customer share

Customer share means the customer's portfolio proportion of the total business volume, which reflects the business share in the stock market. Obviously, customers with smaller customer share have a higher possibility of up-buying.

j. Cross buying possibility

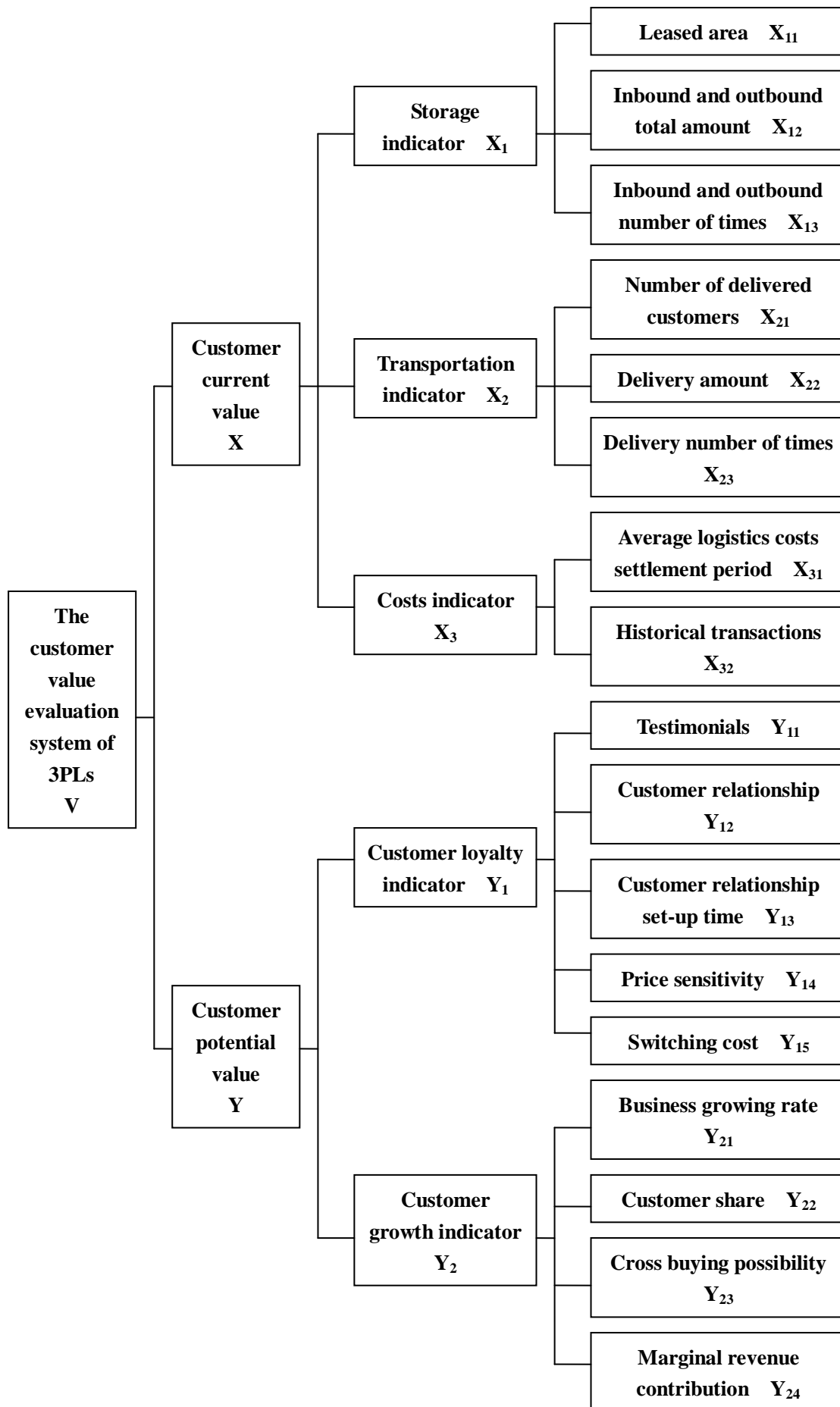
It indicates the possibility of purchasing product types that the customer never reached or the possibility of expanding the business scope. Where there is a higher cross buying possibility, there is a greater cooperation potential.

k. Marginal revenue contribution

It means the ratio of possible purchasing amount and further inputs may be made by third-party logistics providers. It can be calculated in a certain range by the first-line customer manager according to the size and needs of customers.

4.3.2 The establishing of the customer evaluation system of 3PLs

After the above indicator selection analysis, the customer value evaluation indicator system has been finalized as shown in the following Figure 3. The content of customer value indicators can be seen, consisting of an indicator system. Each indicator is not unity, the expression meaning and form of measurement units are very different and can not be directly summed, and the various indicators make contribution to the customer value evaluation with certain differences.



4.4 The Method Selection of 3PLs Customer Value Evaluation

System

4.4.1 The method of indicator dimensionless

Indicators that used to evaluate different aspects of the same thing in a comprehensive evaluation of multiple indicators, often perform in different forms, or in difference on the dimension and magnitude. If you want a comprehensive evaluation of these indicators, the original data for these indicators must be converted into comparable data of homogeneity and same order of magnitude through mathematics, so that indicators of different forms are able to be synthesized and compared. This data processing process is known as indicator dimensionless, also known as the standardization and normalization of data, which is the premise of a comprehensive evaluation.

The dimensionless approach can be divided into three categories: linear type, broken line type and curve type. Linear dimensionless is most widely used among all. The change of actual value of the index causes a corresponding proportion of the change of the indicators evaluation value by assuming a linear relationship lies between the two indicators. The linear dimensionless is able to meet the need of evaluation of the relative position of the object generally, but it is easier than the broken line and the curve method in practice application effect.

Therefore, the linear dimensionless method will be used in this article. There are usually two means named “extremum method” and “standardization method”.

(1) formula of extremum method

$$x'_{ij} = \frac{x_{ij} - \min_{i \leq j \leq n} x_{ij}}{\max_{i \leq j \leq n} x_{ij} - \min_{i \leq j \leq n} x_{ij}} \quad (4-1)$$

The extremum method has features listed as follows:

- a. It has no requirements on the number and distribution of the indicator data.

- b. Transformed data distributes in the 0-1 interval so that it is easier for further math processing.
- c. The relative nature of the transformed data is obvious.
- d. The original data needed in this method turns to be less.

(2) formula of standardization method (Z-Score Formula)

$$x'_{ij} = \frac{x_{ij} - \bar{x}_j}{s_j} \quad (4-2)$$

$$\text{Mean } \bar{x}_j = \frac{1}{n} \sum_{i=1}^n x_{ij} \quad (j = 1, \dots, m)$$

$$\text{Standard deviation } s_j = \sqrt{\frac{1}{n-1} \sum_{i=1}^n (x_{ij} - \bar{x}_j)^2} \quad (j = 1, \dots, m)$$

The method requires the raw data to be showed a normal distribution, thus requiring a number of samples. It was suggested that the raw data should be more than twice the number of indicators. The standardization method has features listed as follows:

- a. It is used when there are a number of objects since the result is reliable only when the raw data are showed a normal distribution.
- b. Transformed data distributes beyond the 0-1 interval with negative existing.
- c. The relative nature of the transformed data is not obvious.
- d. Transformed value is related with any x_{ij} in the actual value.

Through the above comparison of two methods, and according to that indicators in this article do not follow a normal distribution, the extremum method is considered to be more appropriate.

4.4.2 The determination of indicator weights

Weights are magnitudes contrasting and weighing the relative importance of various factors in the object value based on a certain number of forms. The determination of the weights is a fundamental step in the customer value evaluation index system,

which not only decides the importance of the composition factors, but also directly affects the evaluation results. Thus, scientifically determination of the index weight is crucial in this study.

Weights can be divided into substantial weights, valuation weights and information weights according to the nature. Substantial weights are generally difficult to perform in the multi-index comprehensive evaluation, so we won't explore further. Valuation weights refer to weights recognizing the importance of all evaluation factors determined from the perspective of the evaluators, using subjective weighting. Information weights means weights determined by the amount of distinguish information of the objects, using objective weighting. Each method has its own characteristics and certain application circumstances. It is essential to understand their specific principles and features in order to apply appropriate weighting method and make the weights play the role of correctly measuring the importance of the weighted factors.

(1) subjective weighting

Subjective weighting method reflects value judgments or subjective awareness, and its most important feature is that the importance of the evaluation index value given can be directly evaluated. From the statistical theory and the development, subjective weighting method contains experts expert investigation method, pairwise complementary method, and pairwise reciprocal method. The principle and characteristics of subjective weighting methods are shown in the following Table 1:

Table 1 Methods of Valuation Weights

Methods	Principles	Weighting accuracy	Complexity level of calculation	Index number required	Index differentiation required
Expert investigation	Direct weighting	Higher	Higher	Little	Larger

Pairwise complementary	Grading after pairwise comparison	Higher	Lower	Many	Smaller
Pairwise reciprocal	Grading after pairwise comparison	High	Low	Many	Large
Link relative weighting	Grading after sequential comparison	Low	Low	More	Small

By comparing the characteristics of various empowerment methods, in line with the principle of objectivity, simplicity, feasibility and accuracy, pairwise reciprocal method will be adopted in this paper to weight indicators by consideration of various indicators and differentiation between indicators.

Pairwise reciprocal method is derived from the Analytic Hierarchy Process found by Thomas L. Saaty. AHP is an analysis method providing a comprehensive and rational framework for structuring a decision problem, for representing and quantifying its elements, for relating those elements to overall goals, and for evaluating alternative solutions. Specific calculation steps of AHP are shown as follows:

Step 1: establishing the hierarchical structural

Establishing a model with hierarchical structural by methodizing and layering the involved factors as Figure 4. Such framework is basically the same with the customer value evaluation index system in this article, thus it is entirely possible to consider the indicator system as a structural model.

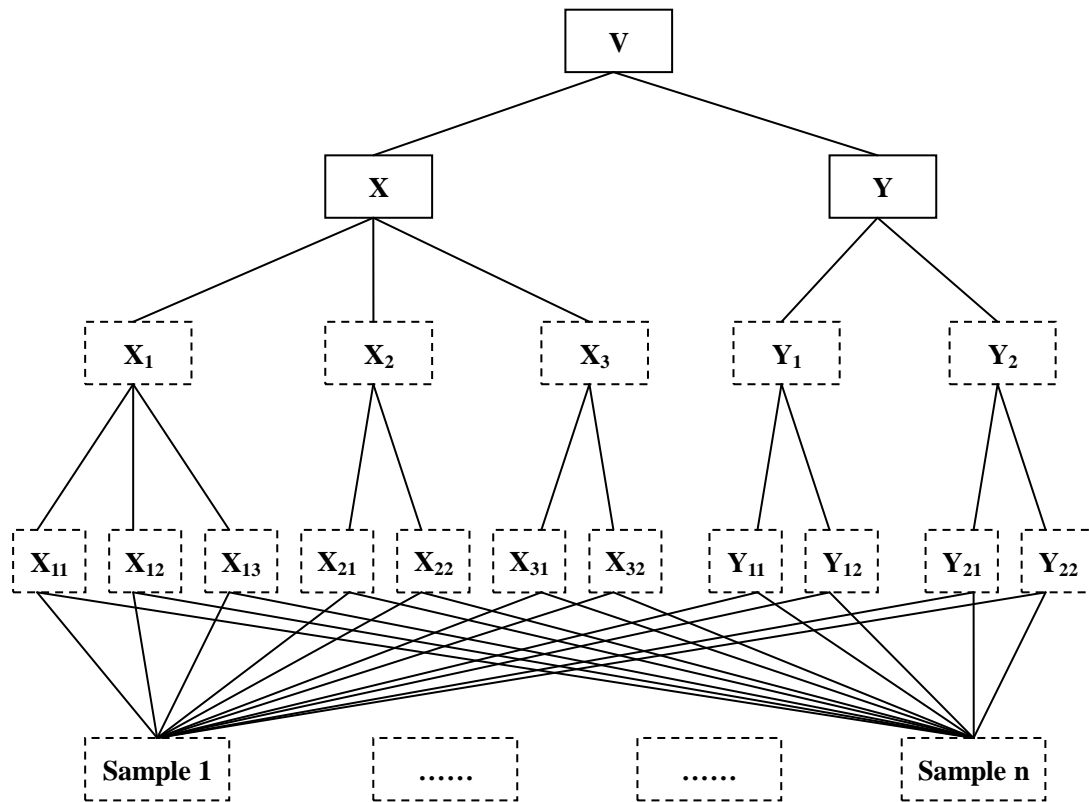


Figure 4 AHP Frame Model

Step 2: adopting the expert survey

Let the decision makers (including marketing manager, marketing center director) repeatedly answer questions to find the important degree of all indicators of the pairwise comparison judgment matrix A.

Table 2 AHP Evaluation Criterion

$X_i:X_j$	Equal Importance	Weak Importance	Essential Importance	Very Strong Importance	Absolute Importance
a_{ij}	1	3	5	7	9
The intermediate state between adjacent results are scaled as 2,4,6,8, $a_{ij}=1/a_{ji}$					

Step 3: determining the relative weight and examining the consistency

a. determining the relative weight

Usually there are adding method, geometric method and eigenvalue method to

determine the weights, among which the eigenvalue method is the most popular. It will be used in this study also to calculate the weights, namely:

$$A\omega = \begin{bmatrix} a_{11} & a_{12} & \cdots & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & \cdots & a_{2n} \\ \cdots & \cdots & \cdots & \cdots & \cdots \\ \cdots & \cdots & \cdots & \cdots & \cdots \\ a_{m1} & a_{m2} & \cdots & \cdots & a_{mn} \end{bmatrix} \quad (4-3)$$

$\omega = (\omega_1 \omega_2 \cdots \omega_n)$ acts as the eigenvector of A. It is usually complicated to calculate the biggest eigenvalue and its eigenvector of the matrix when there are multiple weights. Geometric method is generally used in order to simplify the calculation:

$$\bar{\omega}_i = \sqrt[n]{\prod_{j=1}^n a_{ij}} \quad (4-4)$$

Getting the geometric mean by multiply A with components, and thus we can get a column vector of N sphere $\omega = (\bar{\omega}_1 \bar{\omega}_2 \cdots \bar{\omega}_n)'$. For sake of accuracy, the N sphere has to be normalized and the components can be used as the weights of various factors:

$$\omega_i = \frac{\bar{\omega}_i}{\sum_{i=1}^n \bar{\omega}_i} \quad (4-5)$$

b. examining the consistency

The consistency of the matrix must be examined in order to make sure of the rationality and reliability of the weights' distribution. The steps are showed as follows:

Calculate the consistency index CI, which determines the matrix A.

$$CI = \frac{(\lambda_{\max} - n)}{n - 1} \quad (4-6)$$

$$\lambda_{\max} = \frac{1}{n} \sum_{i=1}^n \frac{(A\omega)_i}{\omega_i} \quad (4-7)$$

Saaty has given RI value to different m, the corresponding RI value shows as the following Table 3:

Table 3 Index Value of Average Random Consistency

Order	1	2	3	4	5	6	7	8	9	10
RI	0	0	0.52	0.89	1.12	1.26	1.26	1.41	1.46	1.49

c. calculating the consistency proportion CR

$$CR = \frac{CI}{RI} \tag{4-8}$$

When CR=0, the matrix is considered to be fully consistent. When CR<0.1, the consistency of the matrix is acceptable. When CR≥0.1, the matrix need to be adjusted to get satisfying consistency.

Step 4: calculating the total weighting of factors of each layer. Assuming that there are factors of number m in the layer A, named as A₁, A₂,...,A_m, and their corresponding weights are a₁,a₂,...,a_m. The proximate layer B contains factors of number n, named as B₁,B₂,...,B_n, the weight value of which towards criterion A_i are b_{1i},b_{2i},...,b_{ni}, and the total order weights of layer B towards layer A show as Table 4:

Table 4 Order Weights of Layers

B \ A	A₁	A₂	A_m	Order weights of layer B
	a₁	a₁	a₁	
B₁	b₁₁	b₁₂	b_{1m}	$\sum_{j=1}^m b_{1j} a_j$
B₂	b₂₁	b₂₂	b_{2m}	$\sum_{j=1}^m b_{2j} a_j$
...
...
B_n	b_{n1}	b_{n2}	b_{nm}	$\sum_{j=1}^m b_{nj} a_j$

(2) objective weighting

Objective weighting method, also known as the weights of information amount, is

determined through the information amount of the evaluated object. Evaluation is used to distinguish the object being evaluated, if certain values of the indicators can clearly separate the objects from each other, the indicator has a large amount of information for distinguishing on this evaluation; Conversely, if certain values of the indicators in each object are the same, then the index will not help to distinguish the objects between each other, and the index can be sifted out of the evaluation system. The amount of valid information can be reflected from so many aspects that the corresponding informative weights can be divided into variation weighting, order weighting, distance weighting, independence weighting. It is appropriate to adopt variation weighting in this study according to the characteristics of keeping more raw data as possible, and the specific computational steps are as follows:

Let x_{ij} be the observed data of number j in the object being evaluated of number i . For a given j , the larger the variation of x_{ij} , the greater the information amount contained by the index. Coefficient of standard deviation represents the degree of variability of this information.

Step 1: calculating the weighted arithmetic mean of the index

$$\bar{x}_j = \frac{1}{n} \sum_{i=1}^n x_{ij} \quad (i = 1, \dots, n; j = 1, \dots, m) \quad (4-9)$$

Step 2: calculating the coefficient of standard deviation

$$s_j = \sqrt{\frac{1}{n} \sum_{i=1}^n (x_{ij} - \bar{x}_j)^2} \quad (4-10)$$

Step 3: calculating the coefficient of variation

$$v_j = \frac{s_j}{\bar{x}_j} \quad (4-11)$$

Step 4: calculating the variation weighting

$$w_j = \frac{v_j}{\sum_{j=1}^m v_j} \quad (4-12)$$

(3) combination weighting

Both the subjective weighting method and the objective weighting method have their

respective advantages as well as the inherent weaknesses that can not be avoided at the same time. Subjective weighting method can only reflect the subjective judgment of experts to value the importance of the index, with no reflection of the actual observed values of each indicator on the specific object. Although it contains a certain degree of subjectivity, it can fully absorb the profound theoretical knowledge of experts in the field and a wealth of practical experience. On the contrary, the objective weighting method can only reflect the actual observed values of each indicator on the specific object, without reflection of the importance of value of various indicators. It contains strong objectivity, but it can not fully absorb advanced theoretical knowledge and practical experience of experts in the field. The advantages of subjective weighting method is exactly the shortcomings of the objective weighting method, while the shortcomings of the subjective weighting method is precisely the objective weighting method has the advantage. The results of subjective weighting method and the results of the objective weighting method come to complementary in a large extent.

If the results of subjective weighting method and objective weighting method are combined together, we are able to fully absorb their respective advantages and abandon their respective shortcomings at the same time. This is called combination weighting method, combining the results of both methods. If you look at it from the original data sources, It comes from not only the judgments of indicators' own value, but also objective observations of the index, and the weighting result of both subjective weighting method and objective weighting method as well. Therefore it gives the weights more scientifically. The combination weighting method will be used ultimately to determine the weights in this study, generally containing arithmetic average method, additive combination and multiplication combinations.

The arithmetic average weighting method is selected in this study:

$$q_j = \frac{1}{k} \sum_{i=1}^k w_{ij} \quad (4-13)$$

q_j is the combination weighting. k is the total amount of the weighting method. w_{ij} is the weighting value of method i towards index j . $j= 1,2,\dots,m$, m is the total number of

index.

4.4.3 The comprehensive evaluation method of the customer value of 3PLs

Acceleration composition method is used in this study in order to classify customers by cluster analysis.

$$z_j = \sum_{j=1}^m \omega_j x_{ij} \quad (i = 1, \dots, n; j = 1, \dots, m) \quad (4-14)$$

z_j is assumed to be the comprehensive evaluation value of the customer number i . ω_j is the weight of index. x_{ij} is the value of customer i in index j . n is the number of customers. m is the number of index.

Taking into account that the external environment and the customer itself are continuous developing and changing, evaluation of customer value is not a disposable task. 3PLs need to analyze and evaluate the value of each customer at regular intervals in order to ensure the accuracy of business decisions.

4.5 Basic Computational Steps of Cluster Analysis

The basic computational of customer segmentation of cluster analysis includes eight steps:

(1) Data transformation

Data transformation transforms each element of the original variable data into a new value according to a specific computing, while the changes of value do not rely on the new value of other data in the original data set. It aims to ease the comparison of index value. It should be noted that because the paper will use the evaluation value of the evaluated objects for the cluster analysis, dimensional analyzes for the indicators of customer value assessment will be used as dimensionless clustering, both in extreme value method.

(2) Distance between measure classes and samples

Different definition of distance between measure classes and samples will cause different methods of cluster analysis. Euclidean distance, Absolute distance and Chebyshev distance are usually used to measure distance between samples. Since accelerations composition method is used in comprehensive evaluation in this paper, absolute distance will be chose in order to maintain the consistency of measurement. The formula of absolute distance (d_1) between sample A and sample B shows as follows:

$$d_1 = |x_{a1} - x_{b1}| + |x_{a2} - x_{b2}| + \dots + |x_{am} - x_{bm}| \quad (4-15)$$

m——number of index

x_{ai} ——value of sample A on index i

x_{bi} ——value of sample B on index i

As for distance between measure classes, definition with small distance through merging classes is not sensitive enough, while that with large distance is easy to be distorted when there is a large sample size. Centroid method with appropriate distance provides good representativeness.

Suppose that G_p and G_q merge into G_r with number of samples as N_p , N_q and $N_r=N_p+N_q$, the distance between G_r and other class G_i is:

$$D_{ir}^2 = \frac{N_p}{N_r} D_{ip}^2 + \frac{N_q}{N_r} D_{iq}^2 - \frac{N_p}{N_r} \frac{N_p}{N_r} D_{pq}^2 \quad (4-16)$$

(3) Calculate the distance between each other sample and get the distance matrix $D^{(0)}$ as well as the central matrix $C^{(0)}$.

(4) Sample clustering

$i = 1$. Sample of number n constitutes one class. Number of classes is k . $G_i = \{X_{(i)}\}$ ($i=1, \dots, n$). At this time the distance between classes is exactly the distance between samples, $D^{(i)} = D^{(0)}$. $i=2$. Repeat the above steps and execute step (5) and (6).

(5) The two classes with smallest distance after merging are considered as one new class. The number of classes will decrease as $k=n-i+1$.

(6) Calculate the distance between the new class and others to get the new distance matrix $D^{(i)}$. If k is still greater than 1, repeat step (5) and (6).

(7) Lineage clustering figure

The lineage clustering figure is drawn according to the clustering result, in which the x axis represents distance and the y axis represents samples, showing the closeness between samples in order to get the difference between customer groups with different value.

(8) Determination of class number

The criterion of Bemirmen will be used according to the practical demand of the enterprise in this study by determining number of classification through distance between each sample clusters.

Chapter 5 Customer Value Evaluation in X Logistics Company

5.1 Obtaining Data

5.1.1 Selecting customer samples

The 15 customer samples in this paper are chosen from existing customers of X logistics company, which have long-term business relationship with X company with small revenue contribution interval but generally occupy more enterprise resources and higher marketing costs. There are three reasons for selection: first, the customer selecting bases on similar principles in a certain extent since there are various customers in X company; second, in order to ensure the contrast effect between customer classification method and original method, revenue contribution of customer samples should cover a certain proportion in the company with little differentiation; last, the amount of samples should not be too large for the sake of easy calculation. The customers are expressed in C1, C2, ..., C15 so as to protect the trade secret.

5.1.2 Subjective evaluation data collected through questionnaire

With the active cooperate of marketing department in X logistics company, expert investigation is able to be carried out, measuring the customer performance through rational design of questionnaires. The evaluating members consist of marketing managers, business executives and front-line account managers. They are required to grade the customers in line with realistic attitude. The specific grading basis shows in Table 5:

Table 5 Customer Rating Basis

Grading level	A	B	C	D	E
Grading value	5	4	3	2	1

Customers get such score as is showed in Table 6. The switching cost index barely shows the differentiation of customer value, so it has been deleted from the system:

Table 6 Customer Rating Value Statistics

Samples	X₃₁	X₃₂	Y₁₂	Y₁₄	Y₂₄	X₁₅	Y₁₄	Y₂₂	X₂₁	Y₂₃
C₁	4	5	2	5	4	4	3	2	2	1
C₂	4	5	3	4	5	3	3	5	1	2
C₃	2	4	2	3	5	2	5	4	5	3
C₄	3	3	2	4	2	4	3	3	3	4
C₅	4	4	5	4	4	3	1	2	2	4
C₆	5	3	4	2	4	4	2	1	1	2
C₇	2	5	3	3	3	4	4	4	3	5
C₈	4	2	1	5	2	5	5	4	4	5
C₉	2	3	4	2	2	3	4	3	5	4
C₁₀	2	3	1	4	3	4	2	3	3	3
C₁₁	3	2	2	3	2	3	1	2	4	4
C₁₂	4	2	5	4	3	4	2	2	3	4
C₁₃	2	4	3	3	4	1	2	5	2	4
C₁₄	5	1	4	2	5	3	1	3	4	3
C₁₅	4	3	2	5	3	2	3	2	4	4

5.1.3 Subjective evaluation data

There is a considerable part of the objective data of the enterprise customers in the evaluation index, so it is essential to get the customer related data from the existing CRM system in accordance with the data from October to December, 2011. The

statistical standard of related index shows as follows:

X_{11} : Leased area = total leased area in last 3 months / 3

X_{12} : Inbound and outbound total amount = total inbound and outbound amount in last 3 months / 3

X_{21} : Inbound and outbound number of times = total inbound and outbound number of times in last 3 months / 3

X_{22} : Number of delivered customers = total mismatching number of delivered customers in last 3 months / 3

X_{13} : Delivery amount = total delivery amount in last 3 months / 3

X_{23} : Delivery number of times = total delivery number of times in last 3 months / 3

The related customer subjective evaluation data show as following Table 7:

Table 7 Relating Customer Subjective Evaluation Data Statistics

Samples	X_{11}	X_{12}	X_{13}	X_{21}	X_{22}	X_{23}
C₁	55600	3456	5538	57	27	35
C₂	52700	920	2580	198	13	78
C₃	49400	7832	1522	89	34	56
C₄	44600	3720	2724	180	19	45
C₅	39700	7811	1056	27	40	102
C₆	34300	6783	1986	360	10	21
C₇	28300	9200	974	42	35	15
C₈	36700	3632	872	90	28	25
C₉	21600	2100	1000	32	21	64
C₁₀	18300	6000	1890	50	36	84
C₁₁	17900	2200	1576	180	22	53
C₁₂	17100	1302	980	86	11	91
C₁₃	16500	7826	558	56	16	34
C₁₄	14570	3683	1050	26	30	25
C₁₅	12342	6820	806	50	17	13

5.2 The Determination of Weights

5.2.1 Data dimensionless

According to extremum method, we can get the dimensionless result as Table 8:

Table 8 Customer Data Dimensionless Result

	X_{11}	X_{12}	X_{13}	X_{21}	X_{22}	X_{23}	X_{31}	X_{32}	Y_{11}	Y_{12}	Y_{13}	Y_{14}	Y_{21}	Y_{22}	Y_{23}	Y_{24}
C_1	1.000	0.306	0.000	0.667	1.000	0.250	0.993	1.000	0.667	0.750	0.567	0.500	0.437	0.250	0.250	0.000
C_2	0.933	0.000	0.534	0.333	1.000	0.500	0.515	0.667	1.000	0.500	0.100	0.500	0.485	1.000	0.000	0.250
C_3	0.857	0.835	0.725	0.000	0.750	0.250	0.189	0.333	1.000	0.250	0.800	1.000	0.971	0.750	1.000	0.500
C_4	0.746	0.338	0.508	0.333	0.500	0.250	0.461	0.667	0.000	0.750	0.767	0.500	0.636	0.500	0.500	0.750
C_5	0.632	0.832	0.809	0.667	0.750	1.000	0.003	0.667	0.667	0.500	0.300	0.000	0.049	0.250	0.250	0.750
C_6	0.508	0.703	0.641	1.000	0.500	0.750	1.000	0.000	0.667	0.750	1.000	0.250	0.631	0.000	0.000	0.250
C_7	0.369	1.000	0.824	0.000	1.000	0.500	0.048	0.333	0.333	0.750	0.000	0.750	0.646	0.750	0.500	1.000
C_8	0.332	0.207	0.843	0.667	0.250	0.000	0.192	1.000	0.000	1.000	0.833	1.000	0.922	0.750	0.750	1.000
C_9	0.214	0.143	0.819	0.000	0.500	0.750	0.018	0.000	0.000	0.500	0.600	0.750	0.194	0.500	1.000	0.750
C_{10}	0.138	0.614	0.659	0.000	0.500	0.000	0.072	0.667	0.333	0.750	0.367	0.250	0.340	0.500	0.500	0.500
C_{11}	0.128	0.155	0.715	0.333	0.250	0.250	0.467	0.333	0.000	0.500	0.867	0.000	0.74	0.250	0.750	0.750
C_{12}	0.110	0.046	0.823	0.667	0.250	1.000	0.180	0.667	0.333	0.750	0.400	0.250	0.437	0.250	0.500	0.750
C_{13}	0.096	0.834	0.899	0.000	0.750	0.500	0.090	0.333	0.667	0.000	0.033	0.250	0.000	1.000	0.250	0.750
C_{14}	0.052	0.331	0.810	1.000	0.000	0.750	0.000	0.000	1.000	0.500	0.200	0.000	0.607	0.500	0.750	0.500
C_{15}	0.000	0.713	0.854	0.667	0.500	0.250	0.072	0.667	0.333	0.250	0.667	0.500	1.000	0.250	0.750	0.750

5.2.2 Index weighting determination

After the comparative analysis and statistics of experts towards the index system through expert investigation, the ultimate weighting matrix and inspection results are showed as follows:

Table 9 Storage Index Subsystem Weighting

X₁	X₁₁	X₁₂	X₁₃	Wi	λ max=3.0092 CI=0.0046 RI=0.58 CR=0.007931<0.1
X₁₁	1	3	2	0.540	
X₁₂	1/3	1	1/2	0.163	
X₁₃	1/2	2	1	0.279	

Table 10 Transportation Index Subsystem Weighting

X₂	X₂₁	X₂₂	X₂₃	Wi	λ max=3.0290 CI=0.014533 RI=0.58 CR=0.025<0.1
X₂₁	1	5	6	0.726	
X₂₂	1/5	1	2	0.172	
X₂₃	1/6	1/2	1	0.102	

Table 11 Cost Index Subsystem Weighting

X₃	X₃₁	X₃₂	Wi	λ max=2.04 CI=0.042 RI=0 CR=0<0.1
X₃₁	1	3	0.2	
X₃₂	1/3	1	0.8	

Table 12 Customer Loyalty Index Subsystem Weighting

Y₁	Y₁₁	Y₁₂	Y₁₃	Y₁₄	Wi	λ max=4.031 CI=0.0103 RI=0.89 CR=0.01161<0.1
Y₁₁	1	3	4	2	0.467	
Y₁₂	1/3	1	2	1/2	0.160	
Y₁₃	1/4	1/2	1	1/3	0.095	
Y₁₄	1/2	2	3	1	0.278	

Table 13 Customer Growth Index Subsystem Weighting

Y_2	Y_{21}	Y_{22}	Y_{23}	Y_{24}	W_i	$\lambda_{max}=4.057$ $CI=0.0188$ $RI=0.89$ $CR=0.02117<0.1$
Y_{21}	1	5	2	2	0.439	
Y_{22}	1/5	1	1/3	1/4	0.075	
Y_{23}	1/2	3	1	1/2	0.193	
Y_{24}	1/2	4	2	1	0.293	

Table 14 Customer Current Value Index Subsystem Weighting

X	X_1	X_2	X_3	W_i	$\lambda_{max}=3.0183$ $CI=0.0091$ $RI=0.58$ $CR=0.015776<0.1$
X_1	1	3	4	0.625	
X_2	1/3	1	2	0.238	
X_3	1/4	1/2	1	0.136	

Table 15 Customer Potential Value Index Subsystem Weighting

Y	Y_1	Y_2	W_i	$\lambda_{max}=2$ $CI=0$ $RI=0$ $CR=0 <0.1$
Y_1	1	2	0.667	
Y_2	1/2	1	0.333	

Table 16 Customer Value Index System Weighting

V	X	Y	W_i	$\lambda_{max}=2$ $CI=0$ $RI=0$ $CR=0 <0.1$
X	1	3/2	0.6	
Y	2/3	1	0.4	

According to the principles of variation coefficient method expounded above, we can get the objective relative weighting value showed in Table 17:

Table 17 Objective Relative Weighting

$W_{x11}=0.452$	$W_{x12}=0.376$	$W_{x13}=0.172$	$W_{x21}=0.412$	$W_{x22}=0.256$	$W_{x23}=0.331$
$W_{x31}=0.643$	$W_{x32}=0.357$	$W_{y11}=0.299$	$W_{y12}=0.170$	$W_{y13}=0.243$	$W_{y14}=0.288$
$W_{y21}=0.255$	$W_{y22}=0.266$	$W_{y23}=0.276$	$W_{y24}=0.203$	$W_{x1}=0.250$	$W_{x2}=0.307$

W_{x3}=0.443	W_{y1}=0.471	W_{y2}=0.529	W_x=0.513	W_y=0.487	
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The ultimate combination relative weighting results calculated by arithmetic method are showed in Table 18. Obtaining the relative weighting result of each index, the final weights of indexes towards total customer value V can be gained with it. The weighting results of various specific indexes are showed in Table 19:

Table 18 Relative weighting Results

	X₁₁	X₁₂	X₁₃	X₂₁	X₂₂	X₂₃	X₃₁	X₃₂
Objective weight	0.452	0.376	0.172	0.412	0.256	0.331	0.643	0.357
Subjective weight	0.540	0.163	0.297	0.726	0.172	0.102	0.200	0.800
Combination weight	0.496	0.270	0.234	0.569	0.214	0.217	0.421	0.579
	Y₁₁	Y₁₂	Y₁₃	Y₁₄	Y₂₁	Y₂₂	Y₂₃	Y₂₄
Objective weight	0.299	0.170	0.243	0.288	0.255	0.266	0.276	0.203
Subjective weight	0.467	0.160	0.095	0.278	0.439	0.075	0.193	0.293
Combination weight	0.383	0.165	0.169	0.283	0.347	0.171	0.234	0.248
	X₁	X₂	X₃	Y₁	Y₂	X	Y	
Objective weight	0.250	0.307	0.443	0.471	0.529	0.513	0.487	
Subjective weight	0.625	0.238	0.137	0.667	0.333	0.600	0.400	
Combination weight	0.437	0.273	0.290	0.569	0.431	0.556	0.444	

Table 19 Ultimate Weighting Results

Index	X ₁₁	X ₁₂	X ₁₃	X ₂₁	X ₂₂	X ₂₃	X ₃₁	X ₃₂
Ultimate weight	0.1205	0.0656	0.0571	0.0864	0.0326	0.0329	0.0679	0.0934
Index	Y ₁₁	Y ₁₂	Y ₁₃	Y ₁₄	Y ₂₁	Y ₂₂	Y ₂₃	Y ₂₄
Ultimate weight	0.0968	0.0417	0.0427	0.0715	0.0664	0.0327	0.0448	0.0475

5.3 Customer Value Evaluation and Segmentation Results

Substituting data after dimensionless in accordance with the relative weighting value calculated above, we are able to obtain the rating and ranking of customers on main indexes as Table 20:

Table 20 Customer Rating and Ranking Results

Customer growth Y ₂	Ranking	Potential value Y	Ranking	Customer total value V	Ranking
0.253	15	0.460	10	0.543	5
0.401	12	0.528	6	0.536	6
0.823	2	0.834	1	0.646	1
0.609	6	0.487	7	0.593	2
0.304	13	0.352	15	0.511	7
0.281	14	0.473	8	0.549	4
0.712	4	0.573	3	0.495	9
0.872	1	0.711	2	0.589	3
0.573	8	0.472	9	0.334	15
0.444	10	0.410	13	0.394	13
0.662	5	0.416	12	0.421	12
0.497	7	0.436	11	0.490	10
0.415	11	0.368	14	0.259	14
0.596	7	0.541	5	0.425	11
0.751	3	0.565	4	0.495	8

Incoming ranking	Customer samples	Storage index X1	Ranking	Transportation index X2	Ranking	Cost index X3	Ranking	Current value X	Ranking	Customer loyalty Y1	Ranking
1	C ₁	0.578	7	0.648	6	0.618	5	0.609	4	0.616	4
2	C ₂	0.588	4	0.404	10	0.603	6	0.542	5	0.624	2
3	C ₃	0.820	1	0.215	15	0.272	10	0.496	7	0.842	1
4	C ₄	0.580	6	0.730	5	0.773	1	0.677	1	0.395	10
5	C ₅	0.728	2	0.757	3	0.387	9	0.637	2	0.386	12
6	C ₆	0.592	4	0.839	2	0.421	7	0.610	3	0.619	3
7	C ₇	0.646	3	0.322	11	0.213	13	0.432	10	0.464	7
8	C ₈	0.418	9	0.433	9	0.629	3	0.492	8	0.589	5
9	C ₉	0.337	12	0.270	13	0.008	14	0.223	15	0.239	9
10	C ₁₀	0.388	11	0.540	8	0.223	12	0.382	12	0.384	13
11	C ₁₁	0.273	14	0.297	12	0.773	1	0.425	11	0.229	15
12	C ₁₂	0.260	15	0.839	1	0.654	4	0.532	6	0.390	11
13	C ₁₃	0.483	8	0.269	14	0.231	11	0.352	13	0.332	14
14	C ₁₄	0.306	13	0.732	4	0.000	15	0.333	14	0.499	6
15	C ₁₅	0.393	10	0.541	7	0.146	8	0.440	9	0.423	8

The article chooses current value and potential value as customer categorical variables to achieve cluster analysis after obtaining the customer value results. The hierarchical diagram as the following Figure 5 indicates the particular analysis circumstances:

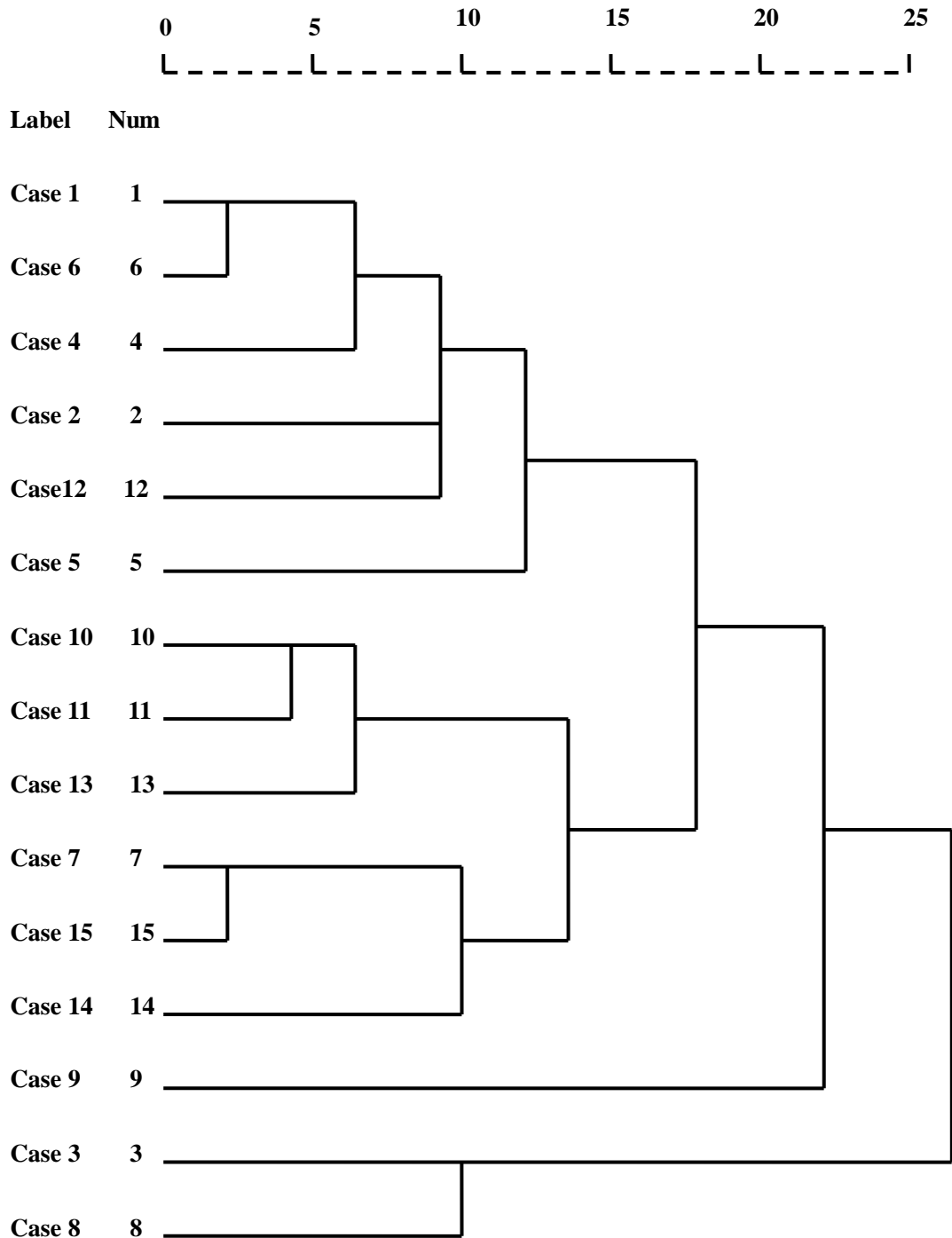


Figure 5 Hierarchical Diagram of Customer Value Evaluation

On the basis of classification criteria and the actual operational needs, we can divide

the current 15 customers into four categories:

VIP customers: C3, C8

Major customers: C1, C2, C4, C5, C6, C12

Common customers: C7, C10, C11, C13, C14, C15

Minor customers: C9

The original segmentation circumstances shows as Table 21:

Table 21 Original Customer Classification

Customer level	Customer samples
VIP customers	C1, C2
Major customers	C3, C4, C5, C6
Common customers	C7, C8, C9
Minor customers	C10, C11, C12, C13, C14, C15

5.4 Analysis Results and Management Strategy

Through the results of the evaluation of customer value, we can find the contribution to customer value ranking has changed.

In accordance with the revenue contribution, customer C1 ranking first ranks only the fifth place in accordance with the customer value evaluation, while customer C3 comes top. This shows that it makes significant difference between relying solely on the warehouse indicators to measure the customer value and relying on the index system which offers two dimensions of the customer's potential value and current value. The former only evaluates the current value of the enterprise customers but the development potential and other parts of customer value, which is likely to cause confusion of the customer relationship development goals and a waste of corporate resources. Through the latter the sources of customer value can be clearly seen. It is able to make a clear distinction between value contribution and potential value contribution. With the right weight, the importance degree of different factors

constituting customer value can be seen vividly. Also, through the comparison between index refinement and customer rating, it is easy to achieve the shortage of client work. Customer value evaluation methods obtain information more comprehensively and scientifically.

The category of customer has changed greatly through the result analysis of customer segmentation. C8, who used to belong to common customer, has been promoted into VIP customer queue, while C9 turns into minor customer. The new method helps to learn the contribution constitution and management strategy. C3 and C8 are both customers with high value, processing high current value as well as potential value. The company should actively maintaining good relationship with such customers. C1, C2, C4, C5, C6, C12 has high current value but low potential value. The company should guarantee high level of products and services, preventing them from losing. C7, C10, C11, C13, C14, C15 own strong purchasing power and growing potential, thus the company should stimulate the potential desire for consumption and try to tap the potential value. As for C9, who has low value both now and in the future, the company should not input too much cost.

We can also distinguish between the management measures of the same class of customers based on indicators of refinement. For instance, customer C3 and C8 are high value customers, but the current value of C3 mainly comes from the warehouse index with low cost indicators, while that of C8 comes from the customer impact indicators with good cost indicators. Business discounts and promotions policy should be provided to C3 to maintain a high volume of business for the purpose with concern about the customer's arrears. As for C8, high-quality products and services should be guaranteed in the purpose of maintaining high quality customer relationship. Since C3 has high level of loyalty and growth in the potential value extent, the inputs can be focused on the development of customer demand and recommendation of new business. C8's loyalty is not high, but the development is very good. Inputs should not be focused only on the customer demand for new business, but also on the customer competition of competitors.

Chapter 6 Conclusion

The core of customer relationship management is customer value management. The researches and studies on the customer relationship management of 3PLs are still in the infancy, and there is no set of comprehensive index system to evaluate customer value at present. On the basis of customer relationship management and customer valuation theory, a customer value evaluation index system of third-party logistics enterprises has been established by combining theoretical research and empirical. Through the case study of X logistics company, we got the results of customer value evaluation and segmentation. According to the new method, the customer information is reflected more comprehensively compared to the former customer classification method. Also, the corresponding customer management strategies are suggested in accordance with the customer value results.

Limited to the length of the article, it is only capable to analyze the business service corresponding with customer relationship management in practical operations and try to discover the rudiment of the customer value evaluation system without verification. This study still has factors with defect by all means. All these blanks in study leave a huge room of growth for future research.

It is a sincere hope for all the third-party logistics enterprises to apply the customer value management theory in practice, bearing the idea of customer-orientation. Through the process of creating value for customers, the industry will gain long-term growth of profit as well as continuous development, achieving a win-win situation.

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