Singapore Management University

Institutional Knowledge at Singapore Management University

Dissertations and Theses Collection (Open Access)

Dissertations and Theses

4-2023

Customer value, product repositioning and supply chain strategy: A case of supply chain design for LANSEA corporation

Lei ZHANG
Singapore Management University, lei.zhang.2017@sjdba.smu.edu.sg

Follow this and additional works at: https://ink.library.smu.edu.sg/etd_coll

 Part of the Business Administration, Management, and Operations Commons, and the Operations and Supply Chain Management Commons

Citation

ZHANG, Lei. Customer value, product repositioning and supply chain strategy: A case of supply chain design for LANSEA corporation. (2023). 1-128.
Available at: https://ink.library.smu.edu.sg/etd_coll/484

This PhD Dissertation is brought to you for free and open access by the Dissertations and Theses at Institutional Knowledge at Singapore Management University. It has been accepted for inclusion in Dissertations and Theses Collection (Open Access) by an authorized administrator of Institutional Knowledge at Singapore Management University. For more information, please email cherylds@smu.edu.sg.

CUSTOMER VALUE, PRODUCT REPOSITIONING AND SUPPLY CHAIN STRATEGY: A CASE OF SUPPLY CHAIN DESIGN FOR LANSEA CORPORATION

ZHANG LEI

SINGAPORE MANAGEMENT UNIVERSITY

2023

Customer Value, Product Repositioning and Supply Chain Strategy: A Case of Supply Chain Design for LANSEA Corporation

Zhang Lei

Submitted to Lee Kong Chian School of Business

in partial fulfillment of the requirements for the Degree of

Doctor of Business Administration

Dissertation Committee:

Lim Yun Fong (Chair)

Associate Professor of Operations Management

Singapore Management University

Wan Guohua (Co-supervisor)

Professor of Management Science

Shanghai Jiao Tong University

Ma Dan

Associate Professor of Information Systems

Singapore Management University

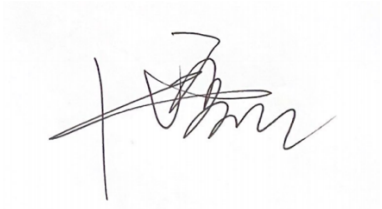
Singapore Management University

2023

Copyright (2023) Zhang Lei

I hereby declare that this DBA dissertation is my original work and it has been written by me in its entirety.
I have duly acknowledged all the sources of information which have been used in this dissertation.

This DBA dissertation has also not been submitted for any degree in any university previously.



Zhang Lei

25th April, 2023

Customer Value, Product Repositioning and Supply Chain Strategy: A Case of Supply Chain Design for LANSEA Corporation

Zhang Lei

Abstract

With continuous development of Chinese economy, the incomes of Chinese citizens are constantly increasing, leading to dramatical changes of consumer demand patterns, especially in household electric appliances. The analysis of income and household wealth shows that the proportion of the middle-class population is about 20%-30% of the total population, and this proportion is still increasing. Consequently, it seems that consumption is constantly upgrading. This means, on one hand, part of the consumers still focuses on quality and cost, while on the other hand, part of consumers pays more attention on performance and styles. Therefore, it is critical for the manufacturers to adapt to customer demand changes so as to create more consumer values.

In this thesis, we study how to construct supply chains for newly introduced products of startup manufacturers.

To achieve this goal, we start from examining the changes of market demands. We analyze the data of consumers in Chinese markets, in particular in small electrical appliances, and show that the growing trends of such products. To catch such demands, the firms have to position their newly developed product well. We then discuss the components of customer perceived values in such situations, including product function and quality, product selection, price and brand, value-added services, and relationship and experience, to help firms

reposition their products. Based on these analyses, we propose an integrated model considering consumer demand changes and customer perceived values. The theoretical framework mainly includes three parts: consumer value creation, product positioning and supply chain design, which is of great significance for companies to explore how to develop or produce new products.

Based on the theoretical framework, we study the supply chain construction for LANSEA Corporation, an emerging domestic hair dryer manufacturer, as an exemplar case to study supply chain construction for a new product manufacturer. We analyze the internal constraints of factory capacity and distribution capacity and the external environment under oligopoly competition, then construct a two-layer supply chain network model, and finally use the stimulation to propose an optimal solution for the real problem. Thus, we demonstrante the viability of the framework and the models through the supply chain construction of LANSEA Corporation, which form a circular process and product development for an evolutionary spiral.

Keywords: Supply Chain Strategy, Supply Chain Network Design, Customer Value, Mathematical Model

Table of Contents

List of Figures

List of Tables

Acknowledgement

Five-year's study in the SJTU-SMU DBA programme has proved as a harvest as well as a big challenge to me, especially in the past three years, I've experienced too many uncertainties. In Shanghai's lockdown, my wife and three children were all "positive" and the COVID-19 overwhelmed me and forced me to slow down my paces, which also allowed me to feel myself physically and mentally, to reconsider independently in the uncertainties, family and health are the source of happiness. Deep gratitude to my wife for her tolerance and support in my study and life.

The completion of this dissertation is attributed to the guidance of my supervisors, Professor Lim Yun Fong from SMU and Professor Wan Guohua from SJTU. Under their careful guidance, my research made great progression. I have learnt a lot from their profound academic background, rigorous research attitude and deep insights on the practices. Their modest will be my lifelong model and would like to express my most sincere thanks and respect to my supervisors.

In addition, I would like to express my appreciation to all instructors who taught me in the course learning period. My thanks also go to my cohorts, who gave me a lot of advice and help in both study and work. The academic discussion and idea exchange among classmates often inspired me both in work and in my life. Special thanks to Ms. Gao Liyun "Elaine", who gave me a lot of help and we've made a profound friendship during the study.

Finally, I want to thank my colleagues and friends. I couldn't make progress in work, study and life without their supports.

Chapter 1 Introduction

With the great development of China's economic level, the income level of residents is also constantly improving. At the same time, the consumption demand has also undergone momentous changes. According to the data provided by the National Bureau of Statistics, China's per capita gross national income exceeded $10,000 in 2019 for the first time. From the perspective of income and family wealth, the middle class in China accounts for about 20%-30% of the total population. Recent studies show that the number of middle classes is still increasing. More importantly, many consumers are upgrading their consumption and they will pay more attention to the design or quality of new products while most consumers still pay attention to cost performance of product itself. Relevant studies indicate that at least 54% of the total consumption in cities is expected to come from the upper middle class by 2022, which also reflects the strong purchasing intention and purchasing power of this group. More affluent households are spending more on leisure and entertainment activities, while also expanding their purchases of consumer goods such as high-end daily necessities and household appliances. As can be seen from the chart below, from 2013 to 2018, China's per capita gross national income and per capita disposable income and other indicators showed a steady upward trend. This reflects an improvement in overall income and living standards. In recent years, due to the epidemic and other reasons, the overall economic growth rate may be affected and fluctuated, but combined with the above data, the overall economic level of China still maintains a good development trend. Residents' demand for consumer goods is also rising accordingly.

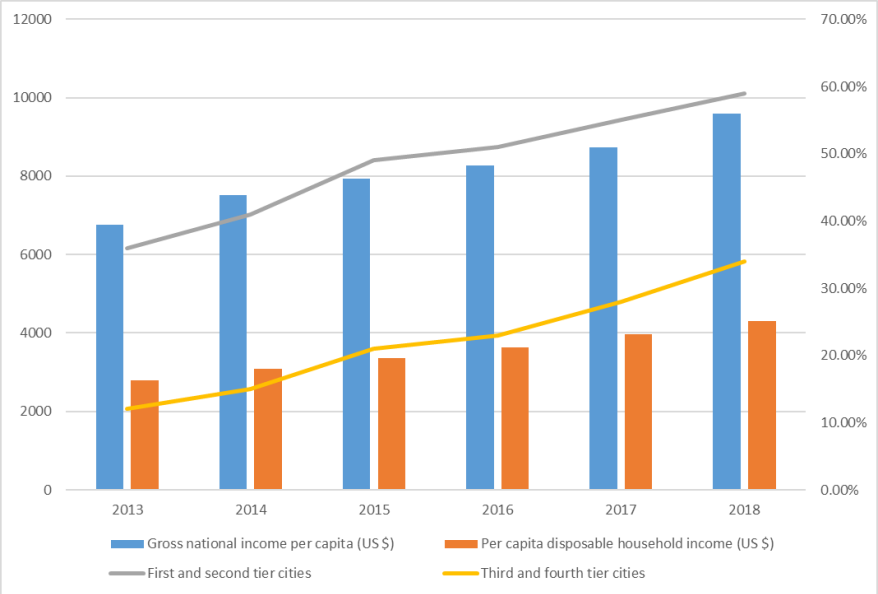


Figure 1-1 Change of Per Capita Income and Proportion of Middle-income Groups

According to the Development Research Center of The State Council, the size of China's middle-income group will reach at least 560 million people by 2024, indicating that the overall purchasing power of domestic consumers will continue to rise, and consumer demand will expand further. For enterprises, the core problem is how to provide better products to satisfy the needs of certain group of consumers. This thesis analyzes from three parts, including consumer value, product repositioning and supply chain strategy, to explore the process of developing new products from the corporate level.

Consumer value can be defined as customers' perception of everything offered by an enterprise, including products, services, and other intangible attributes. The Consumer perception is divided into five dimensions: conformance to requirements, product selection, price and brand, value-added services, and relationships and experiences (Simchi-Levi et al., 2008). In the framework of customer value creation proposed by Smith et al. (2007), four value types are identified and enterprises can create value for customers in these aspects. Among them, empirical value is a key factor, and it emphasizes that products and services can create appropriate experience, emotional

improvement, or resonance for consumers. Therefore, it is an important content of consumer value creation to adapt to the change of customer demand. For enterprises, consumer - centered, continuous innovation is the inevitable need to maintain competitive advantage. Consumer-centered innovation includes many types, such as product renewal, creation of new manufacturing processes, new distribution channels, and new business models (Slater, 1997). It is important for enterprises to provide a variety of product choices so that consumers can select their favored products according to their preferences. Diversified product selection includes product function, style, color, appearance diversity, etc. Different consumers have different preferences for product types. For example, for a hair dryer product, some consumers only have basic functional requirements, while some consumers will have higher requirements for the appearance or performance of the hair dryer. Kotler (2003) defined customer value as the difference between total customer value and total customer cost. Total customer cost refers to the total cost of customers in the process of evaluating, acquiring, and using products or services, including economic cost, time cost, energy cost and psychological cost. Product price is a crucial factor for consumers to measure products, and the way to reduce product cost or price is also the focus of enterprises.

Based on the analysis of consumer value creation, the research further explores the problem of product repositioning. After an in-depth understanding of consumer demand, the enterprise needs to complete the selection of target products based on the external market and the current situation of the company. The product positioning part is divided into two stages, namely market segmentation and product positioning. As emphasized by Freytag et al. (2001), enterprises need to target some consumers to ensure that they can bring some help to the realization of the overall goal of the company, that is, to find those consumers who can help enterprises obtain the maximum benefits and provide services to them. Based on an in-depth analysis of consumer value, it requires careful market segmentation of one type of product. Firstly, it is necessary to complete the

feature identification of certain consumers, that is, to fully analyze the portraits of different consumer groups for diverse types of products, to determine the overall preference of different customer groups. Then we need to analyze the current situation of market competition faced by the company and complete the risk assessment to learn the situations of existing substitutes or products of different subdivisions in the market. It is also significant to combine the preferences of customers and developing trends to identify and assess the possible market risks faced by the certain product. Finally, we analyze the growth of the product to learn about the future development prospects or trends of the product, and to identify the respective advantages of distinct categories of products in the future market. Before targeting the product, company must consider the blockade on core technologies carefully. It has a close relationship with the production of the target product. Constraints on the core technologies will result in the failure of products. Day (1999) provides four steps for repositioning. Firstly, company should identify positioning options. The second is to screen each positioning, judging whether it can provide meaningful products or services for consumers, whether it can improve the competitiveness of the company, whether it has unique advantages that distinguish it from competitors. The third is to set up a unified plan of action for each department and organization of the enterprise. Finally, the company must consider the actual costs and benefits in the process of product production. After completing market segmentation, the company needs to determine target products based on internal and external situations. Firstly, we must analyze the capabilities of resources or existing technologies of the company, including resources related to product production or product design, to explore whether the technology mastered by the company matches the core needs of the product. Secondly, we need to analyze the company's financial situation and explore the feasibility of developing or producing new products from the perspective of capital. Finally, we should analyze the strategic policy implemented by the company, from two aspects, including cost leadership strategy and value advantage

strategy. Then the company can identify subsequent supply chain strategy according to different strategic decisions.

After product repositioning, the company need to identify the specific supply chain strategy. The supply chain section covers two parts, including supply chain strategy and supply chain structure. Pashaei et al. (2015) systematically reviewed the existing literature on the relationship between product structure and supply chain design. Then research classified the existing literature from three levels, including product structure, supply chain and research methods. This thesis identifies different topics related to outsourcing, supplier selection, supplier relationship, distance, and alliance with central companies, and comprehensively explores the relationship between product structure and supply chain design. Firstly, we need to determine the structure of the product, that is, the components of the product to be composed of, such as the shell of the product, the motor, and parts, etc. The product structure contains the various levels of the product components, which can be presented in the form of a bill of materials. After the product structure is determined, the enterprise needs to consider the decision of self-made or outsourcing from the perspective of product production. The target product consists of multiple core components, each of which is achieved by internal production or purchased from external suppliers. This decision-making process is also known as outsourcing decisions. The decision is based on the comparison of the costs of the two production modes. This decision is not only related to the economic profit of the enterprise, but also has an important impact on the design of the entire process and the management of the production and manufacturing process. Then company needs to consider the manufacturing process of the product. In this process, enterprises need to use a series of resources and economic input, including employees, labor, technology or equipment, raw materials and sites and other elements, to produce a series of products or services for potential consumers. After determining the supply chain strategy, company needs to identify the structure of the entire supply chain. Firstly,

company needs to analyze different suppliers from distinct levels to select the most suitable supplier for the entire manufacturing process. In the process of selecting suppliers, enterprises should take concrete, objective, and comprehensive principles as the general principle, determine a complete supplier comprehensive evaluation index system, and make objective and comprehensive evaluation for each supplier. Then enterprise needs to consider the product logistics, including transportation, storage, loading and unloading, circulation processing and subsequent distribution work, etc. Finally, company needs to consider the market competition in the process of identifying the supply chain structure. Competitors in the market affect the relevant decision-making issues of supply chain network design. Facing existing competitors, new entrants must occupy a certain market share through competition to maximize profits. Ignoring the influence of external competition will cause a serious deviation in the revenue forecast and supply chain network design.

The theoretical framework of this thesis covers three main parts, including customers value creation, product positioning and supply chain strategy. The enterprise needs to consider the consumer value at first to identify the changes of customer demand. Then company considers the market segmentation, combining the actual situation of the enterprise itself, to determine the target product positioning. Based on these two parts as motivation, this thesis proposes the supply chain strategy, and determines the structure of supply chain to achieve profit maximization.

Chapter 2 Literature Review

2.1 Customer Value

Consumer value has an important connection with value itself and it is necessary to review and summarize the definition of value. In the philosophical category, value refers to the benefit relation that the object can meet the needs of the subject, reflecting the attribute and function of the object. Value has a relation of utility, benefit, or effect with the needs of the subject. In economics, value usually refers to the utility or measure of utility that products and services have in the market. In the field of marketing, value describes the difference between the estimated utility a consumer obtains and the total cost he or she pays in purchasing a product or service. Therefore, the development and evolution of the concept of value determines the essence and attribute of consumer value to a certain extent. Holbrook (1999) defined consumer value as an interactive, relative, and individual preference consumption experience in his book *Consumer Value*. According to this definition, consumer value has the following four qualities. First, consumer value is the interaction between subject and object. Second, consumer value is a relative concept, that is, the same subject has different preferences for different objects, different subjects have different preferences for the same object, and the same subject evaluates the same object differently in different situations. Third, consumer value has tendency and preference judgment. At the same time, consumer value is also a consumption-based experience. In addition, the study also pointed out that this kind of experience includes but is not limited to the complete process of a product purchase, brand selection, pre -, mid - and post-consumption experience. Consumer value can be defined as customers' perception of everything provided by an enterprise, including products, services, and other intangible attributes. Consumer perceived value is divided into five dimensions: customer demand compliance, product selection, price and brand, value-added services, and relationship and experience (Simchi-Levi et al., 2008). Reviewing the above definition and essence of consumer

value, consumer value is not only the function and quality value of the product or service itself, nor is it only reflected in the evaluation or preference of consumers on the purchase of the product or service but should be the organic unity of the two.

The analysis of several types and constituent dimensions of consumer value can help identify and understand different attributes of consumer value. Sheth et al. (1991) confirmed five types of values affecting consumers' choice behavior through operation and verification in more than two hundred consumption scenarios. The first is functional value, that is, the utility perceived by consumers through the functional or physical properties of goods. The second is social value, which represents the relationship between consumer product choices and a social group. The third is emotional value, which represents how consumers feel by choosing a product or service. The fourth is knowledge value, that is, the curiosity, fresh feeling, and desire for knowledge that consumer behavior can bring to consumers. The last is situational value, which is the perceived utility of consumers' consumption behavior in a specific situation. Kotler (2003) defined customer value as the difference between total customer value and total customer cost, which can be understood as the benefits obtained from specific products or services, including product value, personnel value, service value and image value. Total customer cost refers to the total cost of customers in the process of evaluation, acquisition and use of products or services, including economic cost, time cost, energy cost and psychological cost. Sweeney et al. (2001) selected the retail buying situation as an example and proposed four value dimensions through empirical research. The first involves emotional value, which refers to the utility consumers derive from the feeling and emotional state a product brings to them. The second is social value, which refers to the utility that products bring to consumers by improving their social self-concept. The third is functional value, which refers to the utility brought by the product by reducing the perceived cost of consumers. Finally, there is functional value, which refers to the utility consumers derive from a product's perceived quality

and desired outcome. Holbrook (1999) divided consumer value into eight types from three dimensions, including external and internal, self-directed, and other-directed, active, and passive. The first is efficiency, or convenience, which measures the output-input ratio of consumers in a particular product or service. Excellence, also known as quality, is the ability of a product or service to achieve some goal or function. Then are status, which means that the consumption experience of one subject can be satisfied by the response of other subjects. Respect, like the process of gaining status, is partly a passive process of gaining reputation formed by other subjects. The first four values mostly come from outside, while the last four values come from consumers themselves. It includes the value of fun and beauty, and the former refers to the pleasure that consumers think or get subjectively. The latter is a appreciation and praise of consumption experience as self-directed from the inside. Almquist et al. (2016) believe that many enterprises in the market are trying to seek disruptive innovation, but the disruptive innovation is rare and usually accompanied by industry restructuring. More companies should try to provide consumers with new forms of customer value in existing products or services. Therefore, it is particularly critical to choose what type of value element to be the target object to improve the perceived value of consumers. The study also identifies four distinct types of attributes that consumer value possesses: functional, emotional, life-changing, and social impact.

In view of customer value management, much research has put forward the corresponding theoretical framework to maximize consumer value. Verhef et al. (2013) sorted out the research on customer value management and proposed that enterprises maximize customer value through customer center management system. In view of the problem of how to conduct effective customer value management, the author thinks that there are close relations with the following six aspects. First, CVM is used to improve business performance. CVM usually improves enterprise performance in three forms, including enhancing the competitive advantage of enterprises, improving the

consumer-centered orientation of enterprises and full accountability marketing. The second is to ensure that CVM is more customer-driven rather than IT-driven; The third is to take customer life cycle value as a key measure; Fourth, increase investment in analytical capabilities; Fifth, understand the key factors in customer acquisition, customer maintenance and customer expansion; Finally, create value for customers through management channels. Shanker (2012) proposed a theoretical framework for creating consumer value based on open-source software business. Slater (1997) argues that customer value strategy consists of four parts. The first is to establish a suitable market target; Second, select specific market segments within an industry. Third, make a value proposition to determine competitive advantage. Fourth, continuous development of capabilities has enabled more certainty and delivery of preset value to customers.

In a fiercely competitive market environment, competitive advantages based on products and processes (manufacturing) will be quickly imitated by competitors and lose their advantages. Therefore, continuous innovation is the inevitable need to maintain competitive advantages by taking consumers as the center. Consumer-centered innovation includes many categories, such as product renewal, creation of new manufacturing processes or processes, new distribution channels, new business model discovery, etc. In addition to continuing to understand the consumer, innovation with the consumer at its core requires a close connection between the culture of the organization and the goals of the enterprise and the external consumer. In the framework of customer value creation proposed by Smith et al. (2007), four types of value are identified, and enterprises can create value for customers in these aspects. Specifically including the following four parts, the first is the functional value, that is, the product's own attributes, and can meet the expected goals of consumers. The second is empirical value, that is, products and services can create appropriate experience, emotional improvement, or resonance for consumers. The third is symbolic value,

which can be understood as the inner meaning that the product or service can make consumers to a certain extent. Finally, there is the cost or loss of a product during its use.

Based on the above discussion on the composition and types of customer value, many studies believe that consumer value also plays a vital role in business activities or relationships. In the framework of service-dominant logic, Vargo (2008) believes that the leading role of enterprises is the integration of resources, and enterprises can only provide value propositions but cannot deliver value to customers. The research explored those consumers are always the co-creators of value. Enterprises and consumers constantly exchange their value propositions and value demands in the value allocation market. Gronroos (2011) analyzed the enlightenment of value creation and marketing in business cooperation based on service logic. The author explains that services are multi-dimensional and value creation, purchase, use, and marketing are intertwined. The vendor-customer interaction is the focus of the complete process. Based on the above research on customer value, Smith et al. (2007) also summarized the sources of value, including information, product, interaction, environment, and ownership transfer. The application of the framework includes the following parts: describing market strategy, reinforcing the segmentation concept of products, identifying value creation opportunities, and developing measures of customer value.

2.2 Product Repositioning

Product positioning is an important part of any marketing plan, but it is not limited to one or a subset of consumer’s market. Successful product positioning not only needs to find the accurate information that the product can deliver in the market segment, but also needs to clearly show consumers that the enterprise's products are the best in the specified market segment. When considering product positioning, enterprises' decision-making factors include product attribute, marketing strategy and technology stage. The

decision-making process that considers consumption is also an integral part. Product positioning is a product decision, which usually includes product adjustment, introduction of new products, and abandonment of existing products. Kotler (2000) believes that positioning is a series of related actions taken by an enterprise to design its own products and services and occupy a unique position in the target market segment. Kaul et al. (1995) made a certain distinction between product attributes and product characteristics under the assumption that all consumers use a common product attribute space and that the quantity of products purchased by consumers is independent of price. Product features are defined as a variety of physical representations of the product (length, width, weight, packaging, color, etc.). Product attributes are the perception of consumers and a few product attributes abstracting from these perceptions, which are related to the decision-making process of consumers, while product features can also affect product attributes

To quantify the effect of product positioning, it is necessary to measure cost in the full process, among which manufacturing cost and product marketing are the two most important parts. Manufacturing cost is closely related to product attribute selection. Marketing cost is reflected in advertising, promotion cost, distribution cost and product initiation cost. Product positioning under this framework can be understood as how to select product attribute level and maximize enterprise goals. Product positioning is different from product design, which helps optimize or redesign new products by determining the optimal combination of product features. Porter (1980,1996) proposed two types of positioning strategies, including product differentiation and cost leadership. Product or service differentiation can provide unique characteristics for consumer value identification. Porter believes that these features are carefully designed, developed, and manufactured, as well as incorporating brand influence. A successful differentiation also needs leading investment in scientific research, advertising, product development and customer service management. At the same time, differentiation can bring larger

marginal profits for enterprises. In terms of cost leadership, enterprises achieve economies of scale, low-cost efficiency, and excellent business operation by constantly reducing the average unit cost of products (as much as possible below the industry or industry average).

Past research focuses on how to position the product or implement positioning strategy basing on consumer value creation. Freytag et al. (2001) put forward six concepts and methods to implement positioning, including price, technology, product quality, channel, brand, and service. First, companies need to target a segment of consumers to ensure that they can contribute to the overall goal of the company, which is to find and provide services to the segment of consumers that can help the company achieve the most revenue. Once enterprises can provide unique products and services for these consumers, they will have significant competitive advantages. Kotler et al. (2003) pointed out that in the consumer market, the main segmentation is based on geographical, demographic, psychological and behavioral division, and the relationship among market segmentation, target product selection and positioning is clear. First, it is necessary to identify and divide consumers according to the variables. Then, it is necessary to find the consumers that best fit the company's target characteristics. Finally, it is necessary to position the target consumers and try to turn the enterprise into the only provider of target consumers. An important feature of market segmentation is that a certain segment of consumers after segmentation can be touched by a clear and clear marketing tool. At the same time, a specific market segment needs to have at least the following characteristics: measurability, many consumers, accessibility, significant differences, stability. Ries et al. (2001) suggest that certain product already has a dedicated place in consumers' minds and are difficult to erase or replace. There are three ways to position an enterprise, including strengthening the current position, establishing a new position, and repositioning. Johar et al. (1989) proposed that in marketing activities to establish communication with consumers, the optimal positioning strategy

is a function of situational factors, including product practicality and value proposition. To use localization model accurately and efficiently, nine steps of applying localization strategy are proposed. First, the marketer needs to identify exactly what he is good at (specialty segmentation); The second is to judge and analyze the corresponding consumer experience or activity (behavior subdivision) based on identifying the skill field, which includes activity frequency, activity intensity and tendency. The third is to do relevant market research and identify the consumer object with specific behavior; Fourth, according to the consumer identification information and then collect relevant consumer characteristics data, including location, social, income, organization, etc. The fifth is to complete the competition analysis and consumer benefit segmentation analysis (to evaluate the benefits of consumers in different attributes according to the heterogeneous needs). The sixth step is to benefit from each segment, the marketing personnel need to determine the specific attributes or characteristics of these parts and get the corresponding evaluation criteria. The seventh is to choose the appropriate positioning model. The eighth is to use the correlation model to analyze the mismatch between product portrait and consumer perception. Finally, for those parts that do not match, we need to further consider how to communicate and reposition to consumers in the market

The research on market segmentation is of great significance to product positioning. Freytag et al. (2001) proposed that first, relevant factors such as whether this market segment can continue to grow at a certain speed, reach a certain scale and gain certain profits should be determined. Secondly, enterprises need to evaluate competition and risk. Thirdly, enterprises need to evaluate their own resources, including technology, human resources, brand, capital, technology, and other factors. Locking market target requires enterprises to further select target market segments after completing market segmentation. The application of the 7Ps theory needs to respond to a specific target. When the segmentation target is determined, according to the resources and dominance

of the enterprise, the most suitable strategy combination must be identified with the 7Ps theory to maximize the profit. Hassan et al. (2005) proposed strategic positioning based on market segments. In a two-by-two matrix, the author proposes to match and implement strategies based on whether the market segments in different markets are the same and whether the strategic positioning in the same market segment is the same. When unified market segmentation and unified positioning strategy is adopted, it is called focus strategy and can bring unified product attributes and brand impression to consumers in different markets. When different positioning strategies are adopted in a unified market segment, they are called optimal strategies. The adoption of a unified positioning strategy in different market segments is defined as the central strategy. Using different positioning strategies in different market segments is called localization strategy. The successful product positioning of an enterprise needs to find the accurate information that the product can deliver in the market segmentation. In addition, it can make consumers perceive that the products designed or produced by the enterprise are the worthiest of consumers' purchase in the specified commodity market segments, and the unique advantages of the products need to be presented to consumers.

2.3 Supply Chain Strategy

The supply chain section covers two parts, including supply chain strategy and supply chain structure. It is related with product design and supply chain structure. Supply chain design usually refers to the user demand as the center, using current ideas, new means from the overall perspective of the enterprise to outline the enterprise blueprint and service system. Supply chain design has an important impact on the organizational mode and management mode of enterprises by reducing inventory, reducing costs, shortening lead time, implementing just-in-time production and supply and marketing, and improving the overall action efficiency of supply chain. It aims to improve the service level of users, effectively control the balance between cost and service, to improve the competitiveness of enterprises.

The structure of supply chain itself has a significant impact on the overall operating cost, efficiency and competitiveness, and supply chain design is of great significance to optimize the structure of supply chain. Santoso et al. (2005) explored the problem of supply chain network design under uncertain conditions. Under the assumption of uncertain demand, supply, and cost conditions, they established a stochastic programming model and proposed a sampling average approximation method to minimize the total cost. Thus, the optimal supply chain network design is determined, and the results effectively reduce the volatility of cash flow, which is more significant in the uncertain conditions. Aboolian et al. (2021) proposed two supply chain network design problems for reactive supply chains. Orders of production facilities, the supply chain by the uncertainty of demand and service time, the problem of setting and goal is to minimize the total cost of the supply chain network, including transportation cost, facility relocation cost and production cost, etc., on the basis of the established mathematical model, analyzed the various factors on the influence of supply chain network cost and time to complete the order. Fattahi et al. (2017) studied the design of a multi-stage supply chain network. In this study, a multi-stage stochastic programming model was established to simulate the impact of supply disruptions on facility capacity. Finally, corresponding mitigation and emergency strategies were developed to achieve a flexible supply chain network design. Sadghiani et al. (2015) considered the problem of retail supply chain network design under operational and interruption risks, proposed a deterministic multi-set coverage model, and extended it into a scenario-based robustness model by using scenario generation and interruption analysis, to design a robust and resilient retail network. Cardona et al. (2011) designed a production distribution network. Contains multiple production factory, customers, and a set of candidate of distribution center, the distribution center location and the mode of transportation allocation are considered in the decision making problems, such as customer demand uncertainty, the two phase integer programming model was

constructed, so as to seek the optimal network resource allocation, the purpose is to minimize the total cost and the total service time, A stochastic optimization model is established and solved in the case of uncertain demand. Baghalian et al. (2013) designed a multi-product supply chain network and established a nonlinear mixed integer programming model, which considered the uncertainty of demand side and supply side to make the model more consistent with the actual conditions. They explored the influence of facility location on the decision-making of operation inventory and transportation in the supply chain. The optimal solution of the model is obtained by piecewise linearization method. Yang Yuxiang et al. (2011) explored the location problem of supply chain network facilities in the context of competition. Considering that there are several similar facilities in the market, they analyzed the Stackelberg equilibrium formed by the competition between new entrants and existing enterprises and constructed a decision model of facility location to maximize benefits. Decisions such as facility location, production volume and product price are finalized. Ma Weimin et al. (2015) studied the network design of a three-level reliable supply chain. Considering the uncertainty of supply and demand sides, a new mixed integer programming model is constructed combining p-robust model to minimize the cost under the condition of satisfying given risk preference. The results show that reliable supply chain network performs better than deterministic supply chain network in the case of risk, which provides theoretical support for enterprise supply chain management decision-making.

Past research reveals the integration between supply chain management and marketing can help company to achieve the target of profit maximization. The development of the interface research system between marketing and supply chain management reveals different perspectives and illustrates the complexity of the disciplines involved. Jüttner et al. (2010) developed a framework for integrating supply chain strategies and marketing. The study reviewed the existing literature on the integration of marketing

and supply chain management. There are three perspectives in the thesis, including interactive functional perspective, the process perspective, and the integrated business concept perspective. The proposed framework builds on these views and elevates them to a strategic level. Integrated marketing and supply chain strategy involve four levels of integration management: enterprise integration; Strategic customer integration; Strategic supplier integration and strategic integration of market and supply pipeline. Christopher et al. (2006) discussed the increasing importance of supply chain design in global operations. With the rise of offshore sourcing and the need to improve responsiveness to customer needs, the choice of supply chain strategy is crucial. The evidence presented in this thesis suggests that the choice of supply chain strategy should be based on a complete analysis of the demand/supply characteristics of the unconventional products/markets served by a firm. It provides the basis for the classification of appropriate supply chain strategies. Godsell et al. (2011) finished a field case study of a fast-moving Consumer Goods company that aimed to determine the most relevant basis for supply chain segmentation. The study identified project-level demand analysis (using quantitative and variability classifiers) as the key driver of supply chain strategy. It has also developed a novel analytical tool. This is not only a segmented requirement, but is identified by introducing the concept of filters, a method of translating the results of demand analysis into a segmented supply chain strategy.

The parallel design of product and supply chain is of great significance to maximize the benefit of the system. Gan et al. (2013) found that there was still a lack of research on the method of parallel design of product and supply chain, and introduced a new conceptual framework named parallel design attribute tradeoff pyramid, aiming to establish a certain connection and achieve a balance between product design and supply chain design. The study also introduces the concept of design tradeoff asymmetry and illustrates the influence of design attribute selection on the balance between product and supply chain design. Pashaei et al. (2015) systematically reviewed the existing

literature on the relationship between product structure and supply chain design. The literature is classified from three dimensions of product structure type, supply chain type and research method. Different topics related to outsourcing, supplier selection, supplier relationships, distance from central companies and alliances are identified. The relationship between product structure and supply chain design is studied comprehensively. Sharifi et al. (2006) explored two fields, including product design and development, supply chain design and management, etc. It promotes the concept development of practical model and puts forward the framework of agile supply chain. It is necessary to conduct a comprehensive analysis of the whole market environment, complete product classification, market classification and unstable factors analysis. According to the market and products to develop the overall strategy, and then determine the classification of supply chain, develop specific supply chain strategy, supply chain agility. Baud et al. (2012) discussed the correlation between standardization of products or components and supply chain design. An example is given to illustrate that the decision problem considering both product and supply chain design has a large gain and solving these two problems alone may lead to suboptimal decision. The literature explores an industry case question. The influence of standardization selection on supply chain structure is summarized, and the benefits brought by applying compound optimization model are summarized. The optimal decision of product standardization and supply chain design is determined from the perspective of order quantity and transportation cost.

Supply chain network design usually refers to the scientific and reasonable planning, design and construction of the flow structure of products and information in the supply chain, including node layout, transport route design and capacity allocation. The goal of supply chain network design is to build a supply network structure that adapts to the characteristics of the manufacturer so as to maximize the profit (Farahani et al., 2014). In order to determine the structure of the supply network, the manufacturer needs to

make decisions at all levels, including the number of supply links, location of facilities, transportation capacity and product flow in the network. At the same time, relevant design decisions also need to consider the influence of external market conditions. Due to differences in the practical problems explored, the decision variables selected by different studies are often inconsistent in the process of building specific supply chain network design models. In general, supply chain network design problems mainly include the following three types of decisions.

First, the strategic level. In most cases, strategic decision is closely related to the establishment of supply link, which directly affects the establishment of the whole supply structure. Specific decision variables include the number of supply chain facilities, facility location, facility capacity, the number of outsourcing suppliers. In the model of exploring supply chain network design, Javid et al. (2010) need to make strategic decisions, such as the number of distribution centers to be established, location of distribution centers and capacity limit of arbitrary facilities. In addition, routing and inventory decisions should also be considered, including the establishment of safety stock level, order cycle and other variables. On this basis, a mixed integer programming model is established and some heuristic algorithms are used to solve the specific problem. Shen and Qi (2007) took the number and location of distribution centers in the supply link as the decision variables of the model when exploring the problem of strategic location. By solving the nonlinear integer programming problem, the goal of minimizing the total cost paid by the manufacturer is realized.

Second, the strategic level. According to previous studies, strategy-level decisions are usually related to variables in the supply link and facilities, and have a certain influence on inventory setting decisions of manufacturers, distribution centers, retailers, suppliers and other nodes in the supply chain. In the design model of supply chain network, the widely used policy variables mainly include the quantity of product transportation

between each node and the corresponding mode of transportation, the quantity and type of inventory, the quantity of external supply products, etc. Goh et al. (2007) constructed a stochastic model under the global supply chain network. It is necessary to consider the cross-regional facility location and distribution logistics planning, and complete the commodity quantity decision from the specific factory to the target market under the condition of specific capacity constraints. Finally, the goal of profit maximization and risk minimization is realized by solving the model. Sadjady and Davoudpour (2012) consider two - stage multi - commodity supply chain network design problem to explore the supply chain plan from the strategic level. Specific decisions include location and scale determination of production plant and distribution warehouse, demand distribution at retail end, demand distribution at warehouse end and selection of transportation mode. The objective function of the model is to minimize the total cost, including product transportation, inventory and delivery costs, as well as facility setup and operation costs.

Third, the operational level. Decisions at this level need to depend on external market conditions, that is, consumer demand for products in a specific market, price sensitivity, etc. In addition, consumers' evaluation of supply capacity will also affect the operational decisions of manufacturers. Previous studies have shown that in the design of supply chain network, operational decisions are often involved, including product pricing, supply service level and customer demand satisfaction. Based on the case study of automotive supply chain, Rezapour et al. (2017) constructed the elastic supply chain network design model. The supply ratio corresponding to the market demand, the product price in each market and the inventory level of the terminal retail link are taken as part of the decision variables of the optimization problem. The optimal design of supply network problem is realized by solving the total profit of supply chain with objective function. Fallah et al. (2015) explored the closed-loop supply chain network design in the competitive situation. The factors of competition include the retail price

of new products and the compensation of recycled products. The supply chain consists of manufacturers, retailers and recyclers. The market demand is related to the price and the quantity of returned goods is also related to the compensation amount. This thesis mainly explores the influence of simultaneous game and Stackelberg game on profit, demand and product recovery of two closed-loop supply chains. Under the condition of uncertainty, the thesis adopts the game theory method based on possibility theory to solve the optimal solution of the above model.

To complete the design of supply chain, it is necessary to consider the cooperation and good relationship of each node member of supply chain. Horvath (2001) believes that effective supply chain management relies on cooperation. Strategic supply chain management requires all members of the value chain to collaborate to respond to changing customer needs in real time and improve overall project design and market participation. The literature proposes that the core elements of supply chain management include open and low-cost member connection, large, flexible, and multidimensional data storage capacity, integration of multiple systems and channels, high-level self-service ability, intelligent integration and analysis, and system stability maintenance ability. Petersen et al. (2005), combined with relevant studies, revealed that integrating material suppliers into the process of new product development can effectively promote product development. Suppliers can participate in the discussion of product design and promote the formation of specific decisions or solutions, or they can be fully responsible for the design of supplied parts or related systems. In addition, suppliers may also be involved in distinct stages of the new product development process, and the early participation of suppliers is a key coordination process in supply chain design, product design and process design

Different decision models affect the thinking mode and objective measurement angle of supply chain design. Meixell et al. (2005) reviewed the decision support model for

global supply chain design. It is found that the global supply chain model should cover the factors of internal production and external supplier location, to solve the problem of composite supply chain design. It also includes the need for a global supply chain model to focus more broadly on the multiple production and distribution layers within the supply chain. The performance measures used in the model need to be expanded in definition to address other objectives. The literature finally highlights the need to explore more information about different industries in the context of global supply design. Bashiri et al. (2010) proposed a system thinking method for supply chain design decisions. The constraint theory is applied to the distribution center location problem with one manufacturer and multiple retailers. Under this problem, the customer is faced with a known random requirement and looks for the cheapest candidate location. In addition, the application of equity function in retail store inventory level balance is also explored. Wang et al. (2005) believed that previous studies mostly focused on high-level strategic aspects of supply chain design. Research results are often general guidelines for corporate executives rather than specific tools that plant managers can apply. The literature proposes a decision - based supply chain design method which can be used by factory managers to select suppliers. The method uses the analytic hierarchy process (AHP) and the goal programming technique of priority setting and takes the first-level performance index of the supply chain operation reference model as the decision standard, which is incorporated into the method. In addition, to better evaluate the effectiveness of the entire supply chain, a new set of performance indicators was developed for direct comparison of different supply chain designs Sabri et al. (2000) proposed an integrated multi-objective supply chain model. Both strategic and operational dimensions of supply chain planning. The model adopts multi-objective decision analysis and performance measurement system, including cost, customer service level and flexibility. Compared with the traditional single measurement method, the measurement system provides a more comprehensive system measurement method. In addition, the model also considers the uncertainty of production, delivery, and

demand, and provides a multi-objective performance measurement vector for the whole supply chain network. This inquiry helps to provide more efficient and flexible supply chain design and evaluation of competitive supply chain networks.

Based on the above discussion and analysis of various elements of supply chain design, scholars in related fields continue to deepen the study of supply chain design methodology. Corominas et al. (2015) reviewed previous research on the methodology of supply chain design. The thesis describes a five-stage layered approach (SCOP) and associated concepts and tools that provide a framework for supply chain configuration decisions. Calleja et al. (2017) reviewed methodology for supply chain design or redesign, including an integrated approach and four specific aspects involved in the supply chain design process. The former is a proposal for the entire supply chain design process. The latter includes the definition of supply chain objectives, reverse supply chain, finance, and the generation and use of scenarios, which have a decisive impact on the design of the entire supply chain. The integrated approach covers approaches based on product, market, and different supply chain types, as well as a range of approaches that need to be followed in each stage of supply chain design. The study also found that although the concept of inventory buffer was strongly correlated with shorter lead times, its incidence was low and even independent of other attributes of agile supply chains. Guillen et al. (2005) proposed a multi-objective supply chain design method under the condition of uncertainty. This thesis discusses the design and transformation of a supply chain consisting of multiple workshops, warehouses and markets, and the related distribution system. To consider the impact of uncertainty in production scenarios, a two-stage stochastic model is established to evaluate supply chain performance by considering profit and customer demand satisfaction within a certain time range. In this study, diverse types of alternative models can be obtained by using this method, and the establishment of different models has certain significance in different measurement dimensions. At the same time, the supply chain model obtained

by deterministic mathematical programming is compared with the corresponding stochastic model, and the optimal decision scheme applied to supply chain design is finally obtained.

Supply chain network design is the most important stage that affects the whole supply chain strategy and operation decision. It is associated with various levels of decision making. Rezapour et al. (2014) established a two-tier model for supply chain network design. External is the strategic decision about the design of the supply chain network, which determines the production and distribution costs of products in the supply chain. Nash equilibrium model was established internally, and operational decision was made. The research determines the sales price and service level under the equilibrium condition, and then obtains the profit of the external supply chain, to maximize the overall profit under the condition of meeting the production scale limit. Rezapour et al. (2017) explored the design of supply chain network under the condition of supplier interruption and fierce competition based on a practical case in the automotive supply chain. This study considers strategic decisions from the perspective of supply disruption, including supplier selection and supply chain network structure design. A nonlinear mixed integer programming model is established to maximize the profit of the whole supply chain. On this basis, the effective risk response strategy is determined. Huang et al. (2014) designed the supply chain network from a strategic perspective, considering both supply chain efficiency and risk. The strategic robust supply chain design is defined as the set of all pareto optimal configurations, and a mean-standard deviation robust design problem is established. The results show that pareto optimal supply chain configuration can be obtained within a limited range Sabri et al. (2000) proposed an integrated multi-objective supply chain model and applied it to supply chain planning at both strategic and operational levels. The model adopts multi-objective decision analysis and performance measurement system. Measures include costs, customer service levels and flexibility. Compared with the traditional single measurement

method, the measurement system provides a more comprehensive system measurement method. In addition, the model also considers the uncertainty of production, delivery, and demand, providing a multi-objective measurement dimension for the whole supply chain network. This inquiry helps to provide more flexible and efficient supply chain design and evaluation of competitive supply chain networks

In a highly competitive market, once a company is faced with supply interruption and cannot continue to operate, it is likely to be replaced by its competitors and lose its original market position. The key is to design resilient supply chain networks that allow companies to respond quickly to unexpected events and maintain their competitive advantage. Rezapour et al. (2017) proposed that the supply chain contains uncertainties from various sources, which can be divided into two types: fluctuation and interruption. Among them, the interruption includes many unpredictable, influential, and rare variables, such as the damage of facilities, the suspension of transportation links and the blockade of national borders. Snyder et al. (2006) proposed that it is particularly important to consider the problem of interruption in the design of supply chain network and established a series of models to deal with the problem of supply interruption. This thesis classifies the models based on existing networks, including supply chain networks constructed for the first time and those redesigned to cope with supply disruptions. The classification is further completed based on optimization model and risk measurement. This thesis selects a high-end consumer goods as the object of the case study. The core components of the product involve a few international patents, there are certain technical risks. This is also a cause of supply chain network disruption. Therefore, in the design process of supply chain network, it is necessary to consider the problem of interruption caused by technical risk and formulate appropriate coping strategies.

Chapter 3 Hypothesis Development

3.1 Changes of Customer Perceived Value

In economics, value usually refers to the utility or measure of utility that products and services have in the market. In the field of marketing, value describes the difference between the measurable utility that consumers acquire and the total cost they pay in the complete process of purchasing a product or service. Value itself has different definitions or interpretations on distinct levels. The development of the concept of value determines the essence and attribute of consumer value to a certain extent. Consumer value can be defined as customers' perception of everything provided by an enterprise, including products, services, and other intangible attributes. Consumer perceived value can be divided into five dimensions: customer demand compliance, product choice, price and brand, value-added services, and relationship and experience (Simchi-Levi et al., 2008).

In a consumer-driven market, consumers' perception of product value and the relationship between consumers and enterprises are particularly important. From this perspective, enterprises need to consider or measure product quality (internal) and consumer value-oriented customer satisfaction (external). In the process of supply-driven product production, the main goal of the enterprise is to strictly control the quality level of the product, that is, the enterprise takes product quality as the orientation and provides the quality-oriented products to potential consumers. On the other hand, from the perspective of consumer value orientation, the core issue that enterprises pay attention to is to make a comprehensive analysis of the existing consumer groups of the company's products, customers' use experience of the company's products and their impression on the overall service. Understanding the needs of existing consumer groups can provide valuable information for a company. It can also generate current ideas to better enhance the company's products or services. Currently, the perceived value of

consumers is of special importance to enterprises. Enterprises need to clarify consumers' real demand for products, including product quality, product services and other intangible attributes.

The consumer value perspective drives the development of a company's products or services. It also reveals why consumers choose and buy such products, how to maintain purchasing power for the same products, and why they change their product choices. Through the exploration of consumer value, we can find that different consumers have different preferences or demands for products. How to respond to the needs of different consumer groups is also an important problem to understand consumer value. From the perspective of the correlation between consumer value and supply chain management, responding to customer demand is the most basic principle and goal of supply chain management. Consumer value drives the change and improvement of supply chain to some extent. Part of the impetus comes from the pressure of consumers and competitors, and the other part is to maintain and improve the competitiveness of enterprises. Therefore, consumer value is especially important for the determination of supply chain type and the selection and maintenance of service customers.

The first dimension of consumer value perception is the product availability, which is compliance with customer demand. It describes the ability to provide products or services required by consumers. The ability to fully respond to or meet customer demand is a basic requirement for enterprises, which is closely related to supply chain management. Supply chain management can contribute to product availability and selection. Market regulation of supply chain is the ability to meet the needs and requirements of customers by creating supply force and product choice. When supply is not in line with demand, market regulation consumes additional cost. On the other hand, expanding consumer access to products or services is also an important way to respond to customer demand. Enterprises need to improve the availability or purchase

of products, such as providing consumers with offline experience opportunities or purchase channels, as well as online platforms or websites for information acquisition and understanding.

The second dimension of consumer value is the diversity of product choice, including the diversity of product function, style, color, and appearance. For example, cars of the same brand and model usually have different configurations, colors and so on. Therefore, how to effectively manage a wide variety of products with different configurations whose demands are difficult to predict is a critical issue for enterprise supply chain management. Effective portfolio management of products is particularly important currently. There are three feasible solutions to implement product portfolio management, including specialized provision of a specific type of products, one-stop purchasing channels for multiple products or specialized operation of a large store in a product field. The diversity of products presented in the long tail theory can be realized by using network sales. It also reduces the management cost of multiple products and liberates the limitation of physical stores and local inventory. In addition, the manufacturing to order model used by Dell, for example, can delay production and logistics as much as possible in various parts of the supply chain. It can simultaneously realize efficient management and forecast of demand, and effectively manage the production implementation of supply chain.

Product price and service level are important components of customer value. In general, price is not the only factor customers use to measure a product, but specific products have a narrow price range. For example, commodities, even relatively complex items like personal computers, are commodities, and they have little flexibility in price. Therefore, enterprises gain cost advantage through supply chain innovation. For Dell's direct business model, allowing customers to configure their own systems and build a support supply chain not only improves consumer value but also reduces costs.

However, one of the most key factors affecting product price is brand. The Internet and its influence on consumer behavior have increased the importance of brand. For most customers, brand is a guarantee of quality. Products from top brands are of high quality and high reputation and are priced much higher than products that lack this brand effect. In addition, the price itself also affects consumers' judgment of product quality or reputation. The high profit margin of the product will have a higher demand on the service level. Therefore, the supply chain needs to be more responsive, and the increase in supply chain costs will be offset by higher profit margins.

Value-added services are also an important part of consumers' perceived value. It is difficult for enterprises to achieve competitive advantage through single price competition, which often leads to supply overload. Therefore, enterprises can differentiate their products and stand out from competitors through value-added services. This will further help enterprises to obtain more favorable pricing structure and improve product profits and competitive advantages. At the same time, enterprises provide a series of value-added services to further understand the needs of consumers. To provide customers with better value-added services, enterprises need to further contact with consumers, improve their ability of information acquisition and analysis, and provide customers with convenient information acquisition channels. For the B2B e-commerce market, the barriers to entry are low and companies initially compete primarily on price. As competition intensifies, companies have expanded their services. They also provide a variety of additional services, including finance, logistics and supply chain services. Providing service support can not only generate additional revenue. More importantly, they bring the company closer to its customers, enabling further product improvement, service support, and the search for the next value-added product or service. For example, information acquisition is an important value-added business, allowing customers to access their own data, such as outstanding orders,

payment history and typical orders, which can further bring customers closer to the company.

The last dimension of consumer value is customer relationship and experience, which helps enterprises to increase the connection between consumers by constantly developing and improving customer relationship. How to improve the relationship with customers or consumer experience is an issue that enterprises focus on. This can be done in the following ways. First, enterprises need to create a striking brand personality, such as a unique product that can be recognized by customers. Providing an undifferentiated experience across channels, that is, ensuring that the customer's experience and information are consistent regardless of how the customer chooses to approach the product at any given moment. It is necessary to pay attention to customers' consumption experience and obtain timely feedback and take the quality of consumer experience as the measurement standard of product business. In addition, it is necessary to improve the operation capacity of enterprises. Take customer's information needs and other needs as the core, improve the initiative of serving customers, such as actively reminding customers of the service or experience opportunities. Enterprises need to optimize product or service quality and enhance practical ability based on customer demand. At the same time, effective supply chain management is particularly important to improve customer relationship.

From the analysis of customer value, the relationship between customer value and supply chain management, enterprises need to make clear the choice of target customers and the choice of customer value target. These choices are the basis for supply chain management, market segmentation, and technology implementation. Relevant studies show that enterprises should highlight their advantages in one specific dimension of customer value, make certain distinctions in another dimension, and finally maintain competence in other dimensions. For example, Wal-Mart conducts the price strategy of

low price every day, followed by a complete range of products and brand selection. Target focuses primarily on brand selection, followed by price; Nike focuses on the product experience, then the product itself; McDonald's takes convenience of product supply as its main advantage, followed by service. American Express emphasizes service first and convenience second.

From the definition of consumer value, responding to or meeting customer demand is particularly critical for enterprises. However, with the rapid development of social economy, the income level of Chinese residents is constantly improving, and the consumption demand of consumers has also undergone fabulous changes. According to the statistics provided by the National Bureau of Statistics of China in 2019, China's per capita gross national income exceeded $10,000 for the first time and exceeded the average level of upper middle-income countries. Per capita gross national income includes not only the initial distribution of income obtained by residents participating in various production activities, but also the initial distribution of income obtained by enterprises and governments. Net factor income from abroad is also included. Therefore, there is a significant difference between per capita gross national income and resident income. From the perspective of distribution, the subjects of macro income distribution include residents, enterprises, and the government. From the perspective of income form, it includes the remuneration of workers, depreciation of fixed assets, net production tax and operating surplus. Gross national income and gross domestic product are particularly important economic indicators. Gross domestic product reflects the economic growth and changes of a country, while gross national income reflects the country's income level and macro income distribution. In addition, per capita gross national income is also one of the important indicators to measure the construction of a well-off society in China.

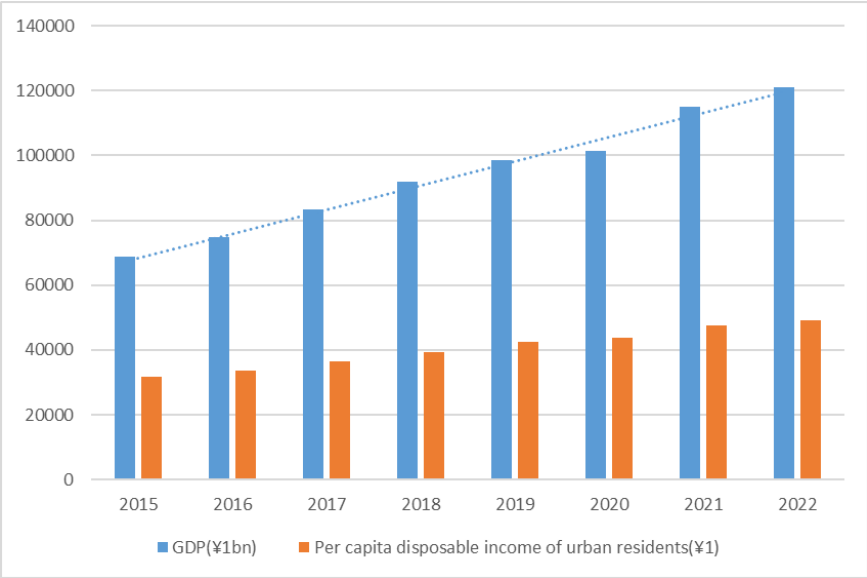


Figure 3-1 Change of GDP and Income for Urban Residents

As can be seen from the chart above, from 2015 to 2022, China's GDP and per capita disposable income of urban residents showed a steady upward trend. This reflects an improvement in overall economic level. In recent years, due to the epidemic and other reasons, the overall economic growth rate may be affected. However, combined with the above data, the overall economic level of China still keeps rising. According to reasonable estimates, residents' demand for consuming goods will also maintain a developing trend.

In recent years, China's resident income level continues to grow rapidly. According to the relevant data of the National Bureau of Statistics, the per capita disposable income of Chinese residents reached 30,733 yuan in 2019, breaking the 30,000-yuan mark for the first time, with a real increase of 4.4 times compared with two thousand, and an average annual real increase of 9.2%. In 2020, China's per capita disposable income reached 32,189 yuan. Considering the impact of price factors, the average annual real growth rate of per capita disposable income of Chinese residents from 2011 to 2020 was 7.2%, double the overall growth rate of 2010. According to the above analysis, the income level of Chinese residents has been significantly improved compared with the

past. This also shows that China has achieved remarkable results in building a moderately prosperous society. With the steady development of the construction of a moderately prosperous society in China, the material standard of living of residents is also improving. In terms of the ownership of major durable consumer goods, there were 96.0 washing machines, 100.9 refrigerators (cabinets) and 115.6 air conditioners per one hundred Households in 2019, and 35.3 cars per one hundred households. This shows that Chinese residents have a large scale of consumption of major durable consumer goods. On the other hand, it also reflects that with the improvement of the average income level of residents, people's consumer demand for household appliances and other major durable goods is also increasing. According to statistics, from 2012 to 2019, the sales revenue of small household appliances industry showed a trend of fluctuating growth, and there was a significant decline in 2018 compared with 2017. Mainly because of the impact of the downstream real estate downward cycle, 2019 has picked up. In 2020, affected by the epidemic, the small household appliances industry achieved a sales revenue of 372.1 billion yuan, down 1.09% year on year.

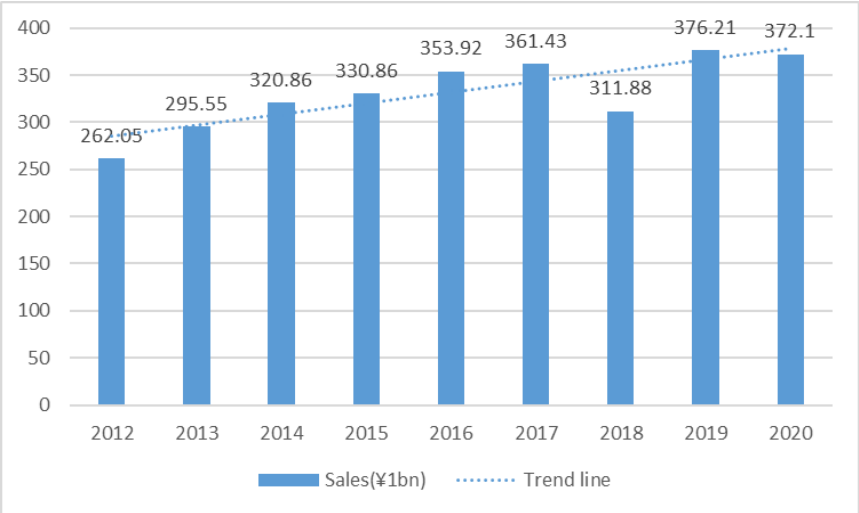


Figure 3-2 Change of Sales for Small Household Appliance Industry

With the continuous improvement of the per capita income level of Chinese residents, the proportion of the middle class is also increasing. To put it simply, the middle class

is a group in the middle-income level of the society. Most of them are engaged in mental labor or manual labor based on technology. They are well-educated, have professional knowledge and strong professional ability, and have the corresponding family consumption ability. They have a certain amount of leisure, pursue the quality of life, and have certain management and control over their labor and work objects. The continuous expansion of the middle class is the cornerstone of a country's stability. Taking income and assets into consideration, consumers can be divided into poor, middle class, and rich class. Studies have shown that compared with the poor group, the middle-class group has stronger purchasing intention and purchasing power. However, compared with the rich class, the middle class has a higher marginal propensity to consume. Therefore, the middle-class group has an important impact on the quality improvement of consumer goods, consumption expenditure structure and consumption form change.

Relevant studies show that from the perspective of income and family wealth, the number of middle classes in China accounts for about 20%-30% of the total population, and the number of this group is still expanding. On the one hand, urbanization enlarges urban boundaries and significantly increases the demand for secondary and tertiary industries. More migrant workers can enjoy the income dividend brought by economic growth and employment structure transformation, and their income level is constantly improving. On the other hand, the number of Chinese university graduates is increasing. The number of returnees also continued to rise, as did higher education levels. Data show that the economic return rate of education in China is constantly improving and has approached the level of developed countries, which creates conditions for the emergence of the middle class, especially the new middle class in the high-tech field. At the same time, the middle class also has an important impact on the changes in China's consumer market. Middle-class incomes are rising faster and most of them are highly educated. Compared with low-income groups, they are less sensitive to the price

of consumption itself. The consumption concept of the middle class is more rational and purposeful. They care more about the intrinsic quality of the add-ons and the added value that the goods can give them than the price. Therefore, they are willing to pay a higher premium, which also creates a larger market purchasing power and can drive the consumption trend of the society.

By 2022, at least 54 percent of total urban consumption is expected to come from the upper middle class, according to the study. This also reflects that this group has a strong purchase intention and purchasing ability. From the perspective of consumption expenditure structure, the expenditure on culture and entertainment, medical care, transportation, and other aspects has a fast growth in the past decade. In addition, tourism, education, leisure, and entertainment are the main components of the consumption expenditure of the new middle class, which reflects the group's pursuit of life quality or quality. In terms of key consumer products, relevant data show that the penetration rate of luxury cars in China rose from 5% in 2013 to 12.4% in 2018, reflecting that people's demand for high-end consumer products has significantly improved. On the other hand, the attention of high-end tourism industry is also increasing, which reflects the change of consumption expenditure structure. Overall, China's retail industry is already the second largest in the world. In 2010, most Chinese urban families had met their basic needs, including food, clothing, housing and transportation, and the median per capita disposable income reached about 21,000 YUAN. By 2020, the figure has more than doubled from 2010 to about 44,000 yuan. More affluent households are spending money on leisure and entertainment activities, while also increasing their purchases of consumer goods, such as eating out regularly, traveling on vacation, and buying high-end daily necessities and household appliances. The Development Research Center of The State Council expects the size of China's middle-income group to reach at least 560 million people by 2024. This shows that the overall purchasing power of domestic consumer groups will continue to rise, and

consumer demand will further expand. How to adapt to the needs of customer groups is the key problem of consumer value creation.

The rapid growth of national wealth in China makes the middle-class group expand continuously, and the structure presents the characteristics of regional center of gravity migration. Relevant analysis shows that the wealth growth of Chinese residents still has immense potential in the future, and the proportion of middle class is expected to further increase. Despite China's large population base, the proportion of people with total wealth between $10,000 and $100,000 is significantly higher than other countries. To some extent, it can be explained that the per capita scale of China's middle class or middle income is large. In addition, the proportion of real estate in the balance sheet of Chinese households or residents has dropped to less than 50%, and the proportion of financial assets has gradually increased. The liquidity of real estate is poor, and the liquidity of financial assets is strong. So, the purchasing power of the Chinese middle class is increasing. There are also analyses that an expanding middle class will support growth in the medium to long term, with stronger consumer spending boosting domestic demand, business confidence and capital spending.

With the increasing number of the middle class in China, the demand of consumer groups is also changing. The 2020 Chinese Consumer Survey report found that Chinese consumer behavior is diverging, from the "general increase" trend of each consumer group in the past to "personalized" and "differentiated" consumption behavior of different consumer groups. Relevant surveys have found that "young shoppers" in middle and low tier cities have become an important consumer group, driving the sustained and substantial growth of Consumer spending in China. This group will pay more attention to the latest trends and buy high-end products to improve their quality of life and social status, rather than caring about saving for the future. It also gives them a lot of purchasing power. This new generation of consumers increased spending

significantly across all the categories covered in the study. At the same time, the number of middle - and upper-middle class consumers is growing rapidly in lower-profile third - and fourth-tier cities. Affluent families, namely those with an annual disposable income of 140,000 to 300,000 YUAN, account for more than 34% of the population in third and fourth tier cities. The rise of e-commerce platforms helps brands extend their sales channels to lower-tier cities, which also promotes young people in lower-tier cities to further increase their consumption spending. With the expansion of the middle class and consumer market, Chinese consumers have unprecedented purchasing power. Consumers will also become the dominant player in the market, using their growing economic strength to exercise the right of free choice for commodities on the market.

At the same time, most consumers tend to upgrade their consumption. Consumers will pay more attention to quality, while some consumer groups will pay more attention to cost performance. Studies have shown that a substantial number of busy and wealthy middle-aged people form a "tasteful middle class". Different from the new generation of consumers, this group pays more attention to the quality of consumer goods and is willing to pay higher investment for high-quality goods. But they do not pay for their social status. On the other hand, in the face of numerous factors in urban life, consumers have a higher pursuit of healthy lifestyle. Consumers with strong health consciousness will pay more attention to their food choices and consciously choose healthier food. The trend is most pronounced in first-tier cities. Compared with the past, Chinese consumers are much more supportive of local brands. Many Chinese enterprises no longer focus on producing low-price products, but pay more attention to the quality, performance, and value of products, and strive to achieve product upgrading. Research on consumer preferences shows that domestic consumers favor local brands in some product categories. These items are necessities such as mobile phones, tablets, and refrigerators. According to research data, 33% to 57% of Chinese consumers prefer

local brands in the above categories. At the same time, more consumers tend to choose local brands for high-end products.

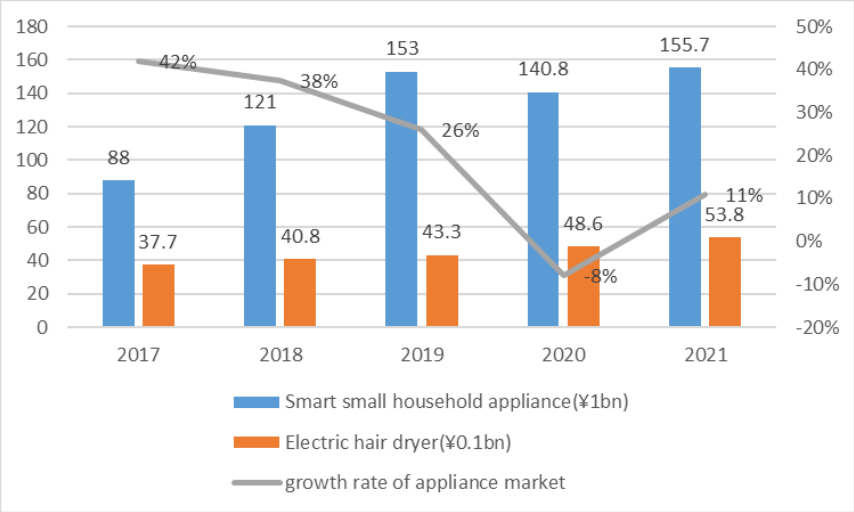


Figure 3-3 Change of Market Size for Small Household Appliance Industry and Hair Dryer

As we can see from the chart above, China's smart small household appliances show a trend of continuous development, with a market size of 155.7 billion yuan in 2021. Existed data show that the total market size is expected to reach 192.4 billion yuan in 2023. In recent years, with the gradual recovery of the hair dryer market and the expansion of demand brought by product upgrading, the replacement frequency of products has also remained at a high level, and the size of the hair dryer market in China has further expanded. In 2021, the market scale of China's hair dryer industry is 5.38 billion yuan, with a year-on-year growth of 10.70%. The details are as the above chart shows.

With the improvement of people's material level, the demand for smart small appliances will no longer be limited to functionality, and will be more to the direction of convenience and beauty. Products tend to be refined. At the same time, although small household appliances generally do not consume much energy, under the background of "carbon peak" and "carbon neutrality", green will be the main melody of future industry

product research and development. On the whole, there are still many enterprises in the smart small household appliances industry that produce homogeneous products and lack the ability of independent innovation. The number of enterprises with differentiation, high-end product design, research and development, production capacity is small. Especially in the field of small household appliances, the overall technology gap between domestic brands and international well-known enterprises such as Philips and Dyson are still relatively obvious. The overall level of the industry still needs to be improved.

In recent years, the year-on-year growth rate of China's total retail sales of consumer goods has been increasing for years. However, with the transformation of economic structure and the change of population structure, consumption growth rate will also be adjusted, which is also in line with the objective law of economic development. In terms of different consumption stages, a series of new products have emerged, including color TV sets, refrigerators, cars and so on. These products have all gone through a phase of rapid growth. At present, China has entered the consumption upgrade stage. The ownership of most daily necessities is close to saturation, so the growth rate of these products will gradually slow down, and more consumers will upgrade their consumption. Relevant studies show that as China's economic development enters a new normal, the consumption stage of imitating the wave has ended, and personalized and diversified consumption has gradually become the current mainstream trend. On the other hand, the trend of consumption upgrading has also accelerated significantly. While the consumption of basic living commodities grows, the growth rate of consumption-upgrading commodities is significantly improving. Some researchers have pointed out that China's economic aggregate is now the second largest in the world, and it is in the stage of moving from middle-income to high-income countries. In this process, people have gradually changed from satisfying food and clothing and material affluence to satisfying spiritual needs, which objectively will bring fundamental

changes in consumption behavior. On the other hand, the process of consumption upgrading usually has a strong agglomeration effect. People's demand for emerging consumption is explosive, so that the time cycle from budding to active emerging consumption is also greatly shortened.

On the other hand, providing diversified product choices is also an important content of creating consumer value. Product diversification itself includes the diversity of product functions, styles, colors, and appearance. In the consumer goods market or the means of production market, the life cycle of new products put on the market is constantly shortening. This has led to more new products coming to market. Different customers have different tendencies or preferences for product types, and consumers always want to choose the products that best suit their own mind. However, for enterprises, product diversity requires enterprises to bear more costs. This will bring higher complexity to the global supply chain, make the difference of customer demand more intense, but also increase the difficulty of inventory management.

Studies show that Chinese consumers still have huge untapped potential. To fully unleash China's consumption potential, reform of the social security system is being accelerated. The one-child policy has also been relaxed and improving people's livelihood has been the focus of the policy. As a result, favorable demographic, geographic and policy factors are all driving the rise of new urbanites, silver-haired and small-city consumers. They will further expand the purchasing power of consumer groups, which will also put forward higher requirements for the quality and diversity of goods. Therefore, enterprises need to be flexible in responding to commodity demand. Not only to adapt to the immediate needs of consumers, but also to adapt to some subtle, long-term needs. In a sense, only by accurately predicting the potential needs of consumers can a brand timely meet the needs of customers and flourish.

Therefore, to further enhance competitiveness, enterprises should analyze the degree of external diversification of products from the perspective of customers, and fully consider the consumption trend, demand characteristics, functional requirements of customers, to pursue more effective and useful diversified distribution. On the other hand, it is necessary to have an in-depth understanding of all kinds of product information, including product sales prospects, profit margins, manufacturing costs and the processing flexibility of enterprises. Enterprises should try their best to reduce the internal cost of product diversification and rationalize the degree of product diversification.

Survey results show that eventually, the public consumers will pay increased attention to the quality and health of consumer goods. At the same time, Chinese consumers' expectations on service, authenticity assurance and product customization are much higher than those of other countries. However, different consumers have different preferences or demands for several factors such as quality, style, and function of various goods. For example, for a hair dryer product, some consumers only have basic functional requirements, while some consumers will have higher requirements for the appearance or performance of the hair dryer. In general, the market for products that satisfy basic functions is easily saturated. This is because the difficulty of product production is small, the entry threshold is low, for some products with high technical requirements, the market is often not saturated, and the needs of some consumers have not been met. Therefore, to better meet the customization needs of customers, it is of great significance to provide diversified product choices.

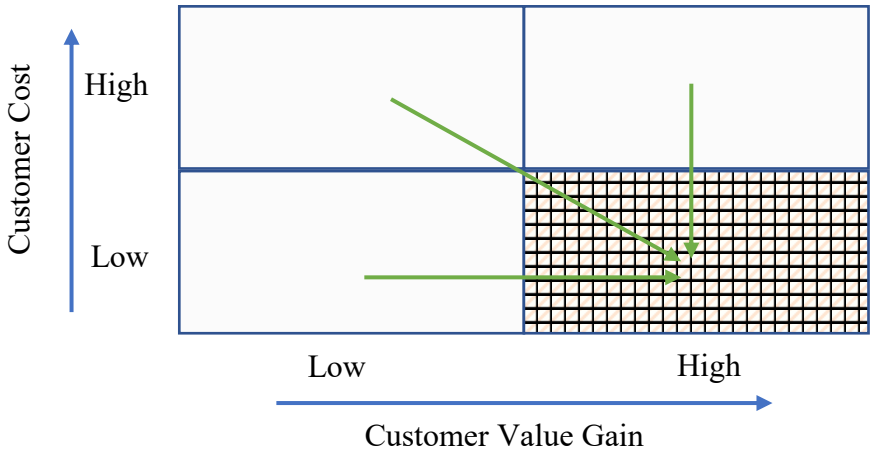


Figure 3-4 Roadmap for Customer Value Creation

Product pricing also has an important impact on the value creation of consumers. The price of products is related to consumers' purchase choices. The pricing of a new product is closely related to whether the new product can enter the market smoothly and achieve good economic benefits, as well as to the recognition or acceptance degree of the new product by consumers. As the figure 2 show, company should not only increase the customer value gain, but also decrease the customer cost to achieve a larger customer value creation. For the same type of products with similar functionality, appearance and specifications, different product pricing affects customers' consumption choices. How to achieve the price advantage of the product by reducing the cost is also a particular concern of enterprises. Different consumers have different feelings about the price of commodities. The consumer's own psychological activities will affect the judgment of the price. As the degree of perception is different, the result of price judgment will be different.

Consumers' judgment of the price is obtained by comparing similar goods or comparing different goods on the same occasion. Therefore, when pricing products, enterprises need to consider the price of comparable products, or the price of other goods at the same sales site, to understand the price perception of consumers. In addition, the

specifications or weight of the product itself will also affect consumers' perception, thus affecting their judgment of price. For distinct brands with similar performance and style, consumers are usually more inclined to buy goods with lower economic cost. Related theories define consumer value as the difference between total customer value and total customer cost. The total customer cost includes economic cost, time cost, energy cost and psychological cost in the process of evaluating, obtaining, and using products or services. As shown in the figure above, how to effectively reduce the total customer cost becomes the key to create consumer value when customer value is improving. It is an important way to improve the total customer value to reduce the overall cost of the product to reduce the price of the product Economic cost is an important content for customers to measure the total cost of goods.

3.2 Product Repositioning

After an in-depth analysis of consumer value creation, the business or company needs to complete the positioning of the target product. First, product positioning is an important part of all marketing plans of an enterprise. Before determining the choice of target products, enterprises should not be limited to the market segment composed of a class of consumers but need to conduct in-depth analysis of the same category of commodity market. On this basis, the company completes the market segmentation of the product, and then determines the choice of target products after in-depth exploration of the internal and external environment of the company. To achieve successful product positioning, enterprises need to look for accurate information that products can deliver in the market segment. And can let the consumer perception, in the specified segment of the commodity market, the enterprise design or production of goods is the worthiest of consumers to choose to buy. Companies need to present the unique advantages of their products to consumers. Often, choosing the segment with the highest return may be the most important strategic decision a business must make, but it is also the most

difficult and demanding. When a company chooses the segment, it wishes to pursue, it also necessarily eliminates some potential segment from its customer base.

After the emergence of the concept of market segmentation, companies realized that they needed to target those customer groups that were most likely to help them reach their goals. Whether it is to maximize profits, maximize market share, or enter a new strategic market, it is crucial to choose a suitable market segment. The basic tenet behind the segmentation concept is to find the customers with the highest rate of return. A company will have a particular competitive advantage if it can bring unique benefits to a particular market segment.

Effective segmentation is a huge advantage for any company that can accomplish this task. First, by analyzing all potential customers, the company can clearly specify the distinctive characteristics of products corresponding to different consumer groups, that is, different user portraits can be obtained by analyzing diverse types of consumers. After completing the task of market segmentation, enterprises can develop specific marketing strategies for one or several defined market segments. In this way, product offering, pricing, promotion, and distribution will be tailored to the needs of each market segment. After completing the task of market segmentation, enterprises can develop specific marketing strategies for one or several defined market segments. In this way, product offering, pricing, promotion, and distribution will be tailored to the needs of each market segment. By identifying the most rewarding market segments, the company will be able to allocate its budget wisely and spend the most on the most profitable and responsive market segments. When the company has identified the market segment and the target product, the company can reallocate resources or re-segment the market according to the market performance at a certain stage and adjust accordingly.

Efforts to develop a market segment often rely on detailed analysis of market research and sales data for specific product lines, but over-reliance on the latter can be detrimental. Some companies segment the market by product type or product size. This single division is limited because it is product-centric rather than customer-centric. In the process of market segmentation, if an enterprise simply defines the entire industry as a segment industry, it will not be able to determine the target products suitable for the enterprise to choose. On the other hand, if an enterprise defines its market segment too narrowly, it will lose some potential customers and may only focus on a few large companies, ignoring the new market segment with potential customers. Studies have shown that a market segment can be defined as a group of customers reached through different market combinations. That is, these customers share certain characteristics that help explain or predict their response to the company's marketing plan.

A good market segment has the following characteristics. First, market segments must be measurable. That is, specific information about the size, expenditure and characteristics of any market segment can be determined through specific research. Second, the market segment must reach a size that justifies the company's human and capital expenditures. Third, market segments can make breakthroughs. Companies must be able to design or produce products or services that match their own and external advantages. If one market segment responds more strongly than another, it may be more attractive to a particular business or company. On the other hand, the best market segments tend to be stable. Although segments can change with product offerings and market changes, the best segments are stable and can justify a company's investment in a particular segment.

Market segmentation usually refers to the market classification process in which marketers divide the market of a certain product into several consumer groups based on the differences of consumers' needs or desires, purchasing behaviors, and purchasing

habits through market research. Each consumer group is a segmented market, and each segmented market is a group of consumers with similar demand tendencies. Therefore, each market segment will also correspond to different product categories and consumer groups with different consumer preferences. Market segmentation is divided from the perspective of consumers according to the theoretical basis of market segmentation, that is, the diversity and difference of consumer demand, motivation, and purchase behavior. At the same time, market segmentation plays an extremely key role in the production and marketing of enterprises. Users in the same market segment have similar needs, behaviors, income levels and characteristics, while the needs and characteristics of total users in different market segments are significantly different.

Market segmentation is the premise of selecting the target market. Its purpose is to allow enterprises to concentrate resources, to provide products or services that better match the needs of users in market segments and develop marketing strategies that better match the attributes of users in market segments. Through price, channel, advertising and other diverse ways, enterprises achieve competitive advantages. First, the completion of market segmentation is conducive to the enterprise to choose a better target market. Without market segmentation, an enterprise cannot develop a specific marketing strategy, nor can it determine its core target products and target consumer groups. Therefore, market segmentation is the basis of target market selection. On the other hand, before market segmentation, the diversity and difference of user needs in the market makes it difficult for enterprises to formulate targeted strategies and draw regular and effective conclusions. According to the differences in user needs, the market is divided into multiple groups. Users in the same market segment have homogeneous needs. An enterprise can determine its target market according to its own situation, including its vision, resources, technical capabilities, and other factors. Second, market segmentation is of great significance to the development of differentiated marketing strategies. Through market segmentation, enterprises can be

more targeted to analyze the demand in the market segment. And from the product, price, location, promotion, and other aspects of the development of a better match with the target market marketing strategy, rather than for all users in the market to provide standardized products or services, the use of no targeted marketing strategy. Third, the implementation of market segmentation is also conducive to rapid response to market opportunities and threats, enabling enterprises to focus more on business, and helping enterprises to understand the trend of the target market more accurately. On the other hand, companies that focus on a niche market can catch new opportunities and threats in a better time than those that focus on a mass market. Enterprises can quickly adjust their marketing strategies, to better respond to market changes and improve their competitive position. Finally, market segmentation helps enterprises reduce waste and improve profits. Through market segmentation, enterprises focus more on resource allocation and better match the target market. For example, the production plan matches the expected sales volume in the target market, the marketing strategy matches the attributes of the target market users, and the design of the product or service matches the needs of the target market users. Market segments enable businesses to devote resources to meeting the needs of specific users rather than adopting a one-size-fits-all strategy. This means that the enterprise is no longer wasting resources on invalid users or non-target users. This will help companies reduce unnecessary risks, reduce costs, and increase profits.

To achieve product positioning and provide the most matched products or services to the target market more effectively, enterprises need to divide the users in the market into several groups with common characteristics. It is of great significance to complete the identification of consumer characteristics. Users in the market differ in demand, consumption level, purchasing behavior and so on. There are numerous ways to segment the market. Common market segmentation methods include the following four:

geographic segmentation, demographic segmentation, psychological segmentation, and behavioral segmentation.

Table 3-1 Consumer Segmentation

Consumer segmentation	***Diverse types of segmentation***
geographic	Geographical location, city, population density, landscape, climate
demographic	Age, life cycle stage, education level, occupation, family size
psychological	Lifestyle, social class, personality traits, values, beliefs, and interests
behavioral	Frequency of use, loyalty, purchase quantity, purchase time, habit

Firstly, from the perspective of geographical segmentation, market segmentation is completed according to the specific location or geographical environment of consumers in the market. The commonly used segmentation conditions include country, province, city, county, or community. Consumer groups in different geographical locations have different consumer needs, product preferences and interests. For example, consumers who live in urban areas tend to choose products differently than those who live outside urban areas. Therefore, it is necessary to fully understand the geographical location information of consumer groups and conduct user segmentation. At the same time, the development level of geographical regions can be used as the basis for differentiation, and the development level of cities can be divided into first-tier cities, second-tier cities, and third-tier cities. Consumers in different regions have different demands. For example, the air pollution in northeast China is more serious due to the substantial proportion of heavy industry cities in the region. Local consumers have greater demand for air purifiers, while the south has better air quality and less demand for air purifiers. On the other hand, climate and terrain are also crucial factors affecting market segmentation. According to the terrain, it is usually divided into plains, plateaus, and

basins. According to the climate classification, divided into tropical, temperate, and cold zones. Due to the natural difference of climate in the north and south of China, the demand for air humidifier by consumers in the south and north of China is also quite different.

Second, market segmentation of consumers based on demographic characteristics. The classification is usually based on gender, income status, age, education level, occupation, family size and religious belief. User demographics are more specific and applicable to a wider range of applications than other segmentation methods. Demographic segmentation is the simplest, most dependable, and most widely used market segmentation method. Demographic factors also influence consumers' choice of products and services. Age and life cycle stage are key factors for user segmentation. Consumer demand will change as consumers grow older. Taking age as the basis of user classification, the consumer market can be divided into children market, teenagers' market, and middle-aged and old market. Different industries, such as clothing, pharmaceuticals, and food, will segment the market according to age, and provide targeted products or services for consumers of different ages. Amazon, for example, has introduced a specific type of tablet aimed at children. On the other hand, many commodities have significant gender characteristics in use, such as clothing, cosmetics, and daily necessities, etc., and consumer groups of different genders may also have significant differences in demand for the same type of products. Female users' demand for perfume smell is quite different from that of men. Men's perfume is more refined and refreshing, while women's perfume is sweeter. If conducted in accordance with the income level of consumer groups, the segment can be divided into different markets such as low-income, middle-income, and high-income, high-income level of the user often also have larger market purchasing power, such as automobile, cosmetics, financial services and jewelry industries are generally based on income as a measure of market segments.

Thirdly, consumers in the market can be identified from the dimension of psychological segmentation. Users are divided according to their lifestyle, personality characteristics, values, personal beliefs, and interests. These characteristics will have a certain impact on the user's choice of goods. Users with the same geographical location and demographic segmentation may have different psychological characteristics. According to the difference of lifestyle, consumers can be divided into simple type, practical type, and luxury type. Among them, frugal users pay more attention to the price factor in the process of choosing goods, practical users consider the practicality of candidate products, while luxury users pay more attention to the unique value of products to show their economic strength and status. This requires enterprises to effectively identify consumer groups with different psychological states and formulate targeted product research and development and marketing strategies to enhance the competitive advantage of products. In terms of the difficulty of segmentation, psychological segmentation is more difficult than geographical or demographic segmentation. This is because the former is more abstract. Enterprises need to conduct in-depth user psychology research to fully understand customers' consumption tendencies or preferences. Coca-Cola uses this psychological segmentation strategy. The target group will be consumers who are concerned about physical health. Coke Zero, with zero sugar and zero calories as the main feature, has won the favor of consumers.

Finally, behavioral segmentation is also an important way of consumer identification, which requires a large number of users to explore the purchase behavior. Purchasing behavior usually refers to consumers' purchasing pattern, loyalty, and usage of a product in the market. On this basis, the user group is subdivided. On the one hand, consumer groups can be divided into light, moderate and heavy users according to the frequency of product use. Enterprises adopt different marketing strategies or operation

modes to improve the overall frequency of product use, to increase the proportion of heavy users and improve the overall revenue of enterprises. On the other hand, according to the specific use of the product, consumer groups can be divided into potential users, unpracticed users, and old users. Enterprises need to use marketing or operation methods to transform potential users into product consumers. As a result, the enterprise enhances the product attraction to inexperienced users, increases the feedback to old users, and expands the user scale overall. On the other hand, user groups can be divided according to product loyalty. In the process of purchasing products, some users will choose only one brand. Some users will choose among a certain number of product brands, while others do not have brand orientation. Therefore, enterprises can compare users' loyalty to distinct brands, analyze the characteristics or advantages of each brand, and complete the improvement of their own products or marketing programs, so as to enhance market competitiveness.

After the completion of consumer characteristics identification, the company has identified the characteristics of consumer groups with different product preferences and needs to conduct market competition analysis on the target product. The completion of competitive product analysis is helpful for enterprises to make detailed product strategic planning, improve the layout of each sub-product line, and provide objective reference information for the implementation of the company's decision. At the same time, by understanding competitors' product information and market dynamics, enterprises can fully explore relevant information and make judgments about competitors' strategic planning or goals. It is also helpful for enterprises to make more reasonable strategic planning. In addition, an enterprise can define its own product positioning or target product selection according to the company background, product development and market share of its competitors. It also helps the company to make timely product adjustment, to maintain product market stability and effectively improve market share. Finally, when an enterprise enters a new industry or produces new products, it is often

difficult to form accurate and effective systematic thinking or direction due to the lack of long-term experience or technological accumulation. Therefore, it is necessary to determine the positioning of new products and improve the overall planning or layout through a more complete analysis of market competition.

To complete the market competition analysis, enterprises need to determine the product competitors. The first category is the direct competitor of the business, usually with the same market target or similar product design. The second category is called as indirect competitors, their target user groups, and the enterprise has a certain difference. It has a relative advantage in terms of the functionality of a particular product, but it does not monetize on that product. The third category is competitors in the same industry but with different operating models. Enterprises can fully understand the information of competitors through different channels, including the official website of the other company, the exchange and interaction platform of the industry and the latest news. Collect necessary information from operations, management, and marketing to establish a market information analysis team for specific products. In this way, enterprises can deeply understand and investigate the diverse needs of core users, active users, and unpracticed users to meet the needs of all kinds of consumers. At the same time, you can also analyze the company's quarterly or annual reports. Enterprises need to timely grasp the core technology, market size, product development and brand influence of competitors, and further understand the actual revenue, market share and profit model of competitors. On the other hand, from the perspective of product function realization, it needs to compare with competitors from multiple aspects, including product functionality, user experience, product appearance and stability.

In addition, enterprises need to conduct risk analysis on existing products in the market, identify potential risk factors that may exist, and evaluate the possible impact. Enterprises need to formulate targeted risk countermeasures, to prevent or reduce

adverse effects. Risk analysis consists of four basic stages. First, market risks need to be identified. This link should pay attention to absorb market experience or lesson. At the same time, try to use "reverse thinking" to complete the evaluation of various products, find the factors that are not conducive to product development, to reveal the potential risk sources of products. The whole identification process should be clear about the specific characteristics of the product, follow the principle of analysis and decomposition, and try to split the comprehensive risk problems into multiple risk factors at diverse levels. Then you need to assess the likelihood of the risk occurring. Combining the two methods of qualitative description and quantitative analysis, we can also try to transform some qualitative factors into quantitative factors to make a comprehensive estimate of the risk. On this basis, further complete the risk assessment. According to the corresponding index system and specific evaluation criteria, the risk degree can be divided to reveal the risk factors that play a key role in the product. Finally, it is necessary to summarize all kinds of potential risk factors faced by the product, summarize the conclusion of risk analysis, and formulate targeted programs or countermeasures, to reduce the possible adverse effects.

From an external point of view, it is necessary to analyze the development prospects or growth trends of different segmented products. By understanding and grasping the future development trend of the product, the enterprise can have a clearer understanding and judgment of the attraction of the product to consumers or the potential value of the product. That is, in a certain period in the future, facing the current market environment, enterprises need to analyze the demand or purchasing power trend of consumers for such products, and judge whether there is a trend of expansion or reduction. According to the segmentation of distinct categories of products, to their market trends for certain judgments and estimates. Through the product related market data mining and analysis, deepen the understanding of the product market environment, but also strengthen the understanding of consumer preferences. When new opportunities or new product

concepts appear in the market, it is of great significance to analyze the growth trend of products for the subsequent market development. The fundamental reason for the change in the market development trend of products is often the change in the demand of consumer groups. The factors influencing the change of user demand include the shift of consumer preference, the change of population structure, and the emergence of competitive products or substitutes in the market. To better analyze the development prospects of products, enterprises can find and read the research reports of the industry in which the products are located to deepen the market understanding of the industry. At the same time, the company needs to pay attention to the development trend or direction of the product. On the other hand, you can get latest ideas or new developments about products from opinion leaders in your industry. Enterprises can also use different tools to deepen their understanding of the industry trend. For example, they can learn about the search trend or the change of the focus of most users according to Baidu index, to deepen their understanding of users.

After the completion of the external market analysis of various products, achieve the target of market segmentation. Based on determining each market segment, the enterprise needs to confirm the target product according to the actual situation of external market and internal company. First, the company's existing resources or mastered technology should be evaluated to find out the company's resources or technology with certain competitive advantages, and then identify and evaluate. Enterprise resources refer to the collection of various production factors that can be used by a company in the process of providing products or services to the outside world and can provide support for the realization of enterprise business objectives. From the perspective of coverage, the company's resources can be divided into tangible resources and intangible resources. The former refers to the visible resources that can be measured by price, covering material resources, technical resources, and financial resources, such as office buildings, workshops, land, production equipment and technical tools. The

latter refers to the intangible resources that a company has accumulated over a prolonged period and cannot even be directly measured by money, such as product brands, corporate goodwill, core technologies, patents, trademarks, and corporate culture. Enterprise resources usually cover all internal factors of production. On the other hand, in addition to analyzing various resource elements of the company, it is also necessary to consider whether the resource allocation is reasonable and further evaluate the development potential. The resources owned by enterprises are discriminated to further clarify the core competitiveness or competitive advantages of enterprises, to provide fanatical support for determining the choice of target products. The analysis of the technology owned by the enterprise focuses on the mining of the core technology. This is because core technologies are often non-replicable and formed based on in-depth exploration of the industry or production and long-term incubation of the environment. Core technologies have unique market value and help solve major market problems. Therefore, it is particularly necessary to analyze the core technology owned by the company, which is related to the confirmation of the selection of target products. Further selection of target products based on the core technology grasped by the enterprise will help give full play to the competitive advantages of the enterprise and bring maximum benefits to the enterprise. This thesis selects LANSEA company as an example, which has mastered the core technology of motor production and can bring significant advantages to the production of high-performance hair dryers.

The determination of target product selection is also closely related to the company's own financial situation. For an enterprise, having a sound financial condition is the key to ensure the smooth development of all businesses. The analysis of the company's financial situation is to understand and evaluate the quality of the financial situation, but also can provide important basis for new product development or business development, help the company to strengthen capital management. At the same time, maintaining a reasonable distribution of funds is conducive to the sustainable

development of the company's business and provides information conducive to decision-making for all parties. For the operation and management personnel of the company, the analysis of financial statements can more directly understand the development status of the company and some problems currently facing, which helps to further improve the quality of operation and management. On the other hand, through detailed analysis of the relevant information of financial statements, we can summarize the development trend and competitive advantage of the company at the current stage. According to the analysis of the company's profit and loss statement, we can understand the company's profitability, operating status, and operating efficiency, which is helpful to judge the company's competitive position in the industry and sustainable development ability. At the same time, the analysis of the company's financial statement can clarify the company's current ability to pay and repay debts, as well as its demand for external funds, and provide sufficient reference information for the future development of the company. Therefore, combined with the company's financial situation, determine the enterprise's positioning of new products, that is, choose a more appropriate target segmentation products, to maintain a good financial situation of the company.

In the process of determining target product selection and product positioning, enterprises must consider the impact of technology constraints on product development. Technology restriction, or technology blockade, usually refers to the process by which one part of the agency in a particular region exerts opaque control over other specific regions. It is widely used in high-tech fields, such as computer, high-end manufacturing, and biological science. In the process of developing new products, enterprises must face a series of problems in technology development. Solving the core technical problems of products is the key for enterprises to achieve new product development. In the middle of the last century, multinational companies started technology blockade against China. After China's accession to the WTO in 2001, the situation of technology blockade

against China by developed countries has undergone some changes. Instead of implementing comprehensive blockade, developed countries have exported backward technologies to China, but they have always maintained high-tech export control over China.

In recent years, the technological blockade caused by Sino-US economic and trade friction has had a great negative impact on the improvement of China's technological innovation level. At present, China is striving to move towards the middle and upper reaches of the global value chain. The United States has always regarded China as a strategic competitor and imposed a technological blockade on China from multiple dimensions, including raising tariff barriers, hindering citizens from investing in the United States, controlling exports to China, and restricting American enterprises from transferring technology through intellectual property rights licensing. These measures not only have a negative impact on normal technology transfer, but also seriously hinder the progress and development of China's high and innovative technologies and increase the risk of China's low-end lock-in in the global value chain. On the other hand, the United States has also imposed restrictions on the choice of major for Chinese overseas students, making it more difficult for key technical talents to enter and exit the country. Such measures make it more difficult for China to introduce overseas technical talents and affect the improvement of China's overall technological innovation level from the side. It also has a negative impact on Chinese enterprises to produce new products and form competitive advantages.

In the process of determining the target product selection, the choice of strategy is also particularly important. Determine different execution strategies according to different product positioning or product selection. When enterprises implement the cost leadership strategy, they are required to reduce production or operating costs, control the overall cost, and make the product price lower than that of competitors, to occupy

the market and gain profits higher than the industry average. Under the strategic guidance of cost leadership, enterprises are required to become manufacturers in the industry to achieve low-cost operation or production. On the other hand, the conditions for cost leadership vary with the industrial structure. Enterprises can reduce the overall cost by seeking economies of scale, patented technology, preferential treatment of raw material supply and other conditions. In the television industry, for example, manufacturers rely on large-scale picture tube production facilities, low-cost equipment design, assembly automation, and global sales scale. While reducing production costs, enterprises can also share the excessive cost of development. In the service industry, to achieve cost leadership, enterprises are required to reduce administrative expenses, control labor costs at a low level, improve the efficiency of training procedures, to reduce costs and improve profits as much as possible.

In different industries, if an enterprise achieves cost leadership and the price of its products or services remains at the average level of the industry, then the enterprise can occupy a certain market share and take a leading position in the industry. However, even if the enterprise has an advantage in cost, if its products or services lag, its competitive advantage will be reduced or even no longer exist. In addition, product prices will be forced to cut, difficult to reflect the leading position. To better implement the cost leadership strategy, enterprises need to conduct in-depth analysis of the value chain. Value chain refers to the business dynamic process formed by a series of interrelated but different business activities, which can create value for enterprises. The value chain of the industry in which the enterprise is located is analyzed to determine its position in the whole value chain. In addition, it is necessary to further clarify the relationship between enterprise and supplier, enterprise, and customer value chain, and make full use of related value chain information or activities. While trying to reduce the cost of each link, the position of enterprises in the industry value chain should be adjusted to achieve cost advantage. According to the complete analysis of the internal

value chain, enterprises determine the most fundamental value chain, and optimize each link of the value chain, improve the overall production or operation efficiency, to achieve the purpose of cost reduction. On the other hand, the implementation of value chain analysis of industry competitors is particularly necessary. Enterprises need to have an in-depth understanding of the quality level, cost composition and production expenditure of competitive products in the same industry. Then compare with the enterprise's own product management situation, analyze the differences in all aspects and take corresponding measures. Thus, as far as possible to reduce the cost of enterprise products, and determine the appropriate pricing strategy, highlighting their competitive advantages.

When enterprises implement value advantage, the products, or services they provide are significantly different from those of their competitors, and they have their own product competitive advantages. The implementation of differentiation strategy requires enterprises to provide unique products to meet the personalized needs of consumers, to cultivate customers' loyalty to the enterprise brand. Differentiation strategies can be implemented in a number of ways, including a unique brand, disruptive technology, creative product look or build, customer service, and other unique advantages. To highlight the characteristics of their products, enterprises can reflect their advantages from different angles. For example, while providing convenient supply services, enterprises can also produce high-quality consumer goods, which often leave a good impression on customers and improve their reputation. Choosing differentiation strategy means avoiding competition with strong brands and opening a different path. However, this does not mean to avoid all competition. Once the enterprise brand enters the market, it will encounter diverse types of competitors. The implementation of differentiation strategy requires enterprises to develop a new area outside the existing market and provide consumers with a new choice of products. To achieve the differentiated survival of the enterprise, rather than competing with the

same industry competitors in the same market. Differentiation does not require an enterprise to be unique, but to fully tap its own unique advantages, fundamentally meet the needs of consumers for differentiation, and realize the competitive advantage of differentiation strategy.

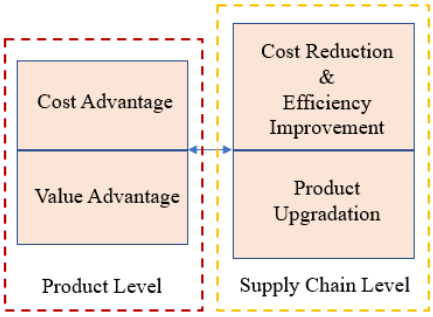


Figure 3-5 Exchange Process

After the enterprise completes the target product selection and product positioning, it needs to further clarify the strategic choice of new products. As shown in the figure above, at the product level, the company's strategy is articulated from two perspectives, including cost leadership and diversification. This also puts forward certain requirements to supply chain design. Supply chain design covers two parts, namely, the design framework of supply chain and the determination of supply chain structure. In the process of completing supply chain design, each link should reduce cost and improve efficiency as much as possible, that is, reduce cost and increase efficiency. On the other hand, the product itself has an important impact on the design of the supply chain, and the realization of product upgrading is conducive to enterprises to win competitive advantages.

3.3 Supply Chain Strategy

In the process of determining the supply chain strategy, enterprises must consider the problem from the perspective of the whole. Supply chain strategy itself not only

includes the whole design framework, but also covers the identification and confirmation of supply chain structure. The process of supply chain design requires the confirmation of product structure and the construction of product production process, as well as the selection of supplier members, the design of logistics system and the analysis of market competition. In the process of designing supply chain, it is necessary to use innovative management thinking. At the same time, it is necessary to reflect the overall thinking of supply chain conception and construction. Inter-enterprise cooperation also plays a key role, requiring different enterprises to have parallel design, to reflect the advantages of parallel operation mode. During the design and construction of the supply chain, it is necessary to carefully explore the operating environment of the supply chain, including geographical conditions, economic development, policy support, culture, and other factors. On the other hand, it is also necessary to measure the impact of environmental changes on the supply chain in the future. For example, the emergence of emerging products or innovative technologies will affect the demand or supply of products. The sudden outbreak of COVID-19 is bound to have a serious impact on the logistics system of products. Therefore, the related issues of supply chain design should be viewed from the perspective of development and change, and the flexibility of logistics system design should be improved, to enhance the adaptability of supply chain to the change of external environment.

Supply chain design should also consider the needs of the increasingly developing manufacturing mode. The resource allocation of the current manufacturing mode is also developing rapidly towards the trend of knowledge intensive, which also has a certain impact on the organization or management mode of the company. Therefore, supply chain management needs to adapt to the constantly developing demand of manufacturing mode, to play a more significant role. Product-based supply chain design requires enterprises to understand the core needs of consumers for products and fully meet the needs of customers. According to the distinctive characteristics of the product,

determine the distinct functions of the supply chain, make the two match each other, improve the competitiveness of the enterprise. Functional products have low marginal profit, but product demand is stable and easy to predict; In contrast, innovative products have higher margins but more volatile demand. The former has a long product life cycle and is used to meet the basic needs of consumers, while the latter has a short product life cycle and is usually manufactured according to order. The corresponding supply chain design requires fast and flexible response, attaches importance to the product needs of customers and can make timely response.

Product design is an important content to propose the design framework of supply chain. It is required to draft and complete the task book of product design first, and then determine the product structure. It covers the preparation, design, and management of technical work in the whole stage and is the basic work of subsequent product production. The product design process determines the function, appearance, and internal structure of the whole product, and then completes the layout design of the product production system, playing a particularly significant role. If the product design itself has some loopholes or related problems, it will adversely affect the subsequent specific production process. On the one hand, it needs to spend a series of costs to adjust the production plan, including production equipment, various materials and labor and other elements. On the other hand, it also affects the progress or process of the whole product production. A perfect product design is conducive to the development of the whole production process. At the same time, it also helps to improve the superiority of product functions, reduce production costs, and enhance the market competitiveness of products.

Enterprises that occupy a dominant position in the industry attach particular importance to product design and believe that this link directly affects the product choice of final consumers. Product design needs to consider various elements, such as natural

environment elements. The rapid development of modern industry has brought about a lot of pollution, which has caused a negative impact on nature that cannot be ignored. Therefore, product design needs to combine the concept of green environmental protection, advocate the harmonious and healthy development of human, nature, and environment. Technical elements, including processing technology, product function realization, core component manufacturing and other technical issues, are the key to determine whether product design can be realized. More importantly, product design should always consider the preferences or needs of consumers, "people-oriented" is also the purpose of product design. Products must be designed to meet the needs of society. Not only short-term social needs, but also long-term development needs in the future. Therefore, the development of advanced technology has always been the focus of enterprise attention, requiring selective and focused introduction of advanced technology and products, as far as possible to fill the technological gap, to win their own competitive advantages. At the same time, product design is also to meet the changing needs of consumers, improve market competitiveness, to obtain higher economic profits. In the design process, not only the performance and quality of products should be considered, but also the use of raw materials and the economy of the manufacturing process should be measured to pursue economies of scale.

Product design requires companies to start from the specific needs of the market and consumers. At the same time, the company also needs to fully consider the requirements of product users. First, it is necessary to ensure the safety of product use and adopt a series of effective protective measures to avoid potential safety hazards or risks in the process of product use and ensure the personal safety of product users. At the same time, it is necessary to consider the ergonomics performance, improve the user experience of the product. In addition, the reliability of product use is also the focus of the design process, to ensure the production quality of products, and facilitate the actual operation and use of users. Product design should also fully consider the appearance and

packaging, under the condition of ensuring product quality and use, increase the ornamental value of products, is also a principal factor to enhance product competitiveness. Manufacturing process requirements the actual structure of the product should conform to the process principle, that is, the use of economic processing methods, under the condition of a certain output scale, to produce products in line with quality standards. In this process, we can reduce the total amount of production as much as possible, reduce the consumption of raw materials, shorten the production cycle of products, to achieve the reduction of the overall production cost.

To complete product design, enterprises need to determine the final product structure, that is, the specific design and composition of the target product. The product structure contains the breakdown of the various levels of the product, which can be presented in the form of a bill of materials. With the gradual diversification of consumer needs, enterprises need to produce distinct types of products to meet customer needs, and the product structure becomes more complex. For manufacturing enterprises, product structure records all kinds of product information, including all kinds of raw materials, assembly components, components and the quantity required to produce a single finished product. The product structure design includes the internal structure of the product and the mechanical part of the design, the realization of the product function often depends on the reasonable structure design. Product structure is not only an important part of mechanical design, but its design process is also one of the most complex links, in the whole product production process, plays a particularly vital role. Structural design needs to conceive of a series of parts to complete the realization of various functions, but also to ensure the compact structure of the product.

After the product design is completed and the product structure is determined, the enterprise needs to consider the decision of self-made or outsourcing from the perspective of product production. The target product consists of multiple core

components, each of which needs to be acquired by internal production or purchased from external suppliers. This decision process is also known as outsourcing decision making. The decision is based on comparing the costs of the two modes of production. This decision is not only related to the economic profit of the enterprise, but also has an important impact on the selection of the entire process and the management of the production and manufacturing process. To realize the maximum economic benefits, enterprises must consider a range of factors related to self-production and outsourcing. First, we should consider the cost. If an enterprise chooses to make itself, the cost includes the purchase and maintenance of production equipment and the cost of raw materials needed. In the internal production process, costs include labor costs, inventory costs, and other related processing costs. However, the cost of purchasing from an external supplier includes at least the price of the outsourced product itself, shipping costs, and associated sales taxes. On top of that, companies need to consider a range of additional costs associated with completing outsourcing deals with suppliers. From the perspective of product quality, the quality of self-made parts is easier to control and improve. The quality of outsourced product components is difficult to be managed or guaranteed. If it brings corresponding quality risks to the final product, enterprises should choose to make their own products to ensure product quality. It is also necessary to consider the reliability of the supply chain. Enterprises should establish perfect and reasonable procurement system, strictly control the quality control, to ensure the reliability of suppliers. From the perspective of technology or materials, the production technology of some parts is beyond the scope of the enterprise's ability, or the raw materials needed are particularly scarce, etc., so the enterprise cannot use the existing technology to make or process parts. Under such conditions, the enterprise can only choose to purchase products. In terms of production flexibility compared with internal production, outsourcing parts have stronger flexibility, which is convenient for enterprises to achieve flexible transfer in various products. The change of external demand has certain requirements on the adaptability of enterprise manufacturing

system. When external demand changes, outsourcing parts can effectively reduce the production burden of enterprises. To a certain extent, it improves the adaptability of production system. Other factors will also affect the choice of self-manufacturing or outsourcing, including technology patent conditions, the maintenance of the relationship between suppliers and enterprises and relevant policies.

Enterprises need to consider the manufacturing process of products after completing the decision of self-made or outsourcing. In this process, enterprises need to use a series of resources and economic input, including staff labor, technology or equipment, raw materials and sites and other elements. Enterprises produce and obtain a series of products or services, to provide the vast number of consumers. How to efficiently produce the required products under the premise of ensuring product quality to maximize economic benefits is the focus of enterprises. There are many diverse types of production processes that can be adopted under the condition that the production objectives preset by the enterprise are met. Selecting the production process that best meets the production needs of enterprises to conduct the implementation can bring greater economic benefits. Enterprises need to establish and improve the production plan, which requires the arrangement of specific production tasks and production schedule, to form a scientific and reasonable production process.

The production process of an enterprise can be divided into various categories but interrelated process stages according to the different processing methods. The production mode or processing nature of any process stage is different, belonging to a local production process, composed of a number of different working procedures. Working procedure refers to the basic unit that makes up the production process, but also the continuous production activity. The production process includes two kinds of basic working procedure and auxiliary working procedure. The former directly to the object of labor related production activities, so that its further into the product. The

latter is to create conditions for the orderly development of production activities, including transport processes, product inspection processes. The transportation process needs to complete the transportation of labor objects between each process, and the inspection process is to complete the inspection of raw materials, semi-finished products and finished product quality required by the production process. Reasonable division of each working procedure plays a crucial role in the whole production process, including the establishment of labor quota, labor distribution, product quality inspection and production work plan. Therefore, the proper completion of process division has an important impact on product production. In the process of product production, if a large number of comparable products need to be produced at a time, the method of batch production is adopted. If an enterprise needs to produce distinct categories of products, it is required to choose a more complex production process.

After putting forward the overall design framework, enterprises need to further complete the identification and confirmation of supply chain structure. In the process of supply chain design, it is necessary not only to confirm the target product structure and subsequent production process, but also to complete the selection of supplier members, the design of logistics system and the management of product channels. Supplier selection refers to the analysis of multiple suppliers for a specific product and the selection of the most suitable supplier. In selecting suppliers, enterprises should take concrete, objective, and comprehensive principles as the general principle, build and determine a complete supplier comprehensive evaluation index system, and make objective and comprehensive evaluation for each supplier. The evaluation system includes various indicators, such as supplier performance level, equipment management ability, production quality, technology research and development, cost control and customer satisfaction index, etc. Enterprises need to conduct targeted, in-depth, and meticulous research on each supplier, and learn the details of each candidate

supplier as much as possible. After comprehensive evaluation and analysis, the enterprise needs to choose the most suitable supplier for itself.

In the process of selecting suppliers, enterprises should first consider the principle of target positioning. It is necessary to focus on the overall quality, total quantity, and quality requirements of the purchased products, and select suppliers according to the above conditions. On the one hand, ensure that the selected procurement channels meet product quality requirements, reduce the procurement risk. On the other hand, it can also improve customers' trust and satisfaction on enterprise products and help enterprises occupy the target market. At the same time, suppliers should be on the same scale as buyers as possible. Total purchases from a single supplier should not exceed 50% of that supplier's capacity. In addition, enterprises need to control the number of suppliers of the same product to 2-3 and establish the primary and secondary. Enterprises need to consider the principle of complementary advantages, and the business ability and technology level of selected suppliers should meet the expected requirements of enterprises. But in some areas, suppliers should have more outstanding capabilities than enterprises, to achieve complementary advantages of both sides. Especially for the selection of important parts suppliers, enterprises should deeply understand the technical ability, capacity level, quality control and long-term supply ability of the candidate suppliers, to determine the unique advantages of the selected suppliers. In selecting suppliers, enterprises should ensure the recruitment of the best. In the case that the quotation, supply quality, delivery conditions and other indicators of multiple candidate suppliers are the same, enterprises need to comprehensively investigate other conditions of each supplier, such as reputation, popularity, and long-term supply ability. Companies should establish strategic partnerships with suppliers. In the actual operation of cooperation, determine the common interest relationship, enterprises can more timely and effective response to market fluctuations and changes, to occupy a larger market share.

In the process of selecting suppliers, enterprises need to comprehensively measure the influence of numerous factors. First, we need to consider the price of raw materials, parts or basic products provided by suppliers. Supply price directly determines the price of products and the input-output ratio of the supply chain itself. Therefore, it will have a greater impact on the operating profit of manufacturers. The quality of the products or components supplied by the supplier is a key factor in measuring the quality of the supplier. Supply quality is the fundamental element of supply chain management, which directly determines the value of final goods. If the product quality has a big problem, it may directly lead to the loss of market competitiveness of the product, or even withdraw from the whole market. Therefore, quality is always the most principal issue in supply. On-time delivery is also one of the factors that manufacturers value. It requires the supplier to deliver the specified product to the place of supply on time according to the corresponding standards proposed by the ordering merchant. If the supplier's delivery is not timely, it will have a certain impact on the manufacturer's entire production plan and subsequent sales links, and even cause a large amount of waste of raw materials. On the other hand, the flexible production capacity of suppliers directly affects the production flexibility of enterprises. A strong flexible production level is conducive to improving the diversity of consumer goods, helping enterprises adapt to the changing needs of consumers, and improving market share and operating profits. In addition, enterprises need to consider other factors such as design capability, delivery lead time and geographical location in the process of confirming supplier members. After comprehensive evaluation, determine the final cooperative supplier. In the process of selecting supplier members, assessment, bidding, and negotiation can be adopted. Finally, the enterprise identifies the most suitable supplier.

After the completion of product production, enterprises need to consider the logistics work of products, including transportation, storage, loading and unloading, circulation

processing and subsequent distribution work. Enterprises use basic management concepts and methods, around the logistics activities to carry out planning, organization, coordination and control work, so that the logistics activities in an orderly manner. Enterprises complete coordination and cooperation between activities, reduce logistics costs as much as possible, improve logistics efficiency at the same time, to maximize economic benefits. Logistics is an important part of supply chain design. Enterprises need to move products from the production place to the target consumption place and build reasonable service mode and perfect service process. Logistics work should first ensure customer satisfaction, put consumer recognition of the product in the first place. At the same time, to pursue the maximization of the overall interests of the enterprise, flexible use, and processing of logistics information, effectively improve the efficiency and effect of logistics links. On the other hand, the logistics link should fully consider the balance between cost and service and try to improve the various elements of the logistics system to improve the overall efficiency of the logistics system. Logistics service needs to have the appropriate performance in the following aspects, including quality, time, place, quantity, impression, price, commodity, etc.

It is the fundamental factor to realize logistics value to complete the transportation of goods under the condition of satisfying time and place. Enterprises can rely on third-party companies to outsource the entire logistics business to professional logistics enterprises, or they can independently design their own logistics transportation system. Third party logistics companies usually have large-scale transport vehicles, equipped with logistics facilities often cover the entire regional transport network. Therefore, designing efficient and reasonable transportation system for enterprises is the primary task of third-party logistics companies. According to the actual needs to choose the mode of transportation to meet the needs of enterprises, and then conduct the organization and arrangement of specific transportation operations.

For the storage work in the logistics process, enterprises can establish their own storage warehouses, or rent external warehouses to complete the management of inventory products. Before an enterprise makes the decision to build its own warehouse or outsource, it needs to consider all aspects related to logistics service comprehensively to maximize the economic benefits of the enterprise. Packaging operations in the logistics process require a series of processing tasks for sales packaging, including packaging combination, splicing collocation, reinforcement and other work, so as to form a combination unit suitable for logistics work. The subsequent distribution link is the process of delivering products to final consumers, which belongs to the end work of logistics system. General distribution tasks include loading and unloading, storage and transportation and other logistics functions, is the embodiment of logistics activities within a short distance. In addition to the above links, sorting and distribution is also the main activities of distribution, but also the unique requirements of distribution. Distribution task is to improve the entire transportation process, control the inventory level, and improve the convenience of logistics and economic benefits. On the other hand, loading and unloading task is also an important link in the logistics system. Third-party logistics companies often have more professional loading, unloading and handling equipment, including loading, unloading, transportation and palletization and other handling equipment, so as to improve the operation efficiency of the whole logistics process and effectively reduce the ordering cycle. The information processing function of logistics system is also particularly important. Only by real-time collection and analysis of information in each link of logistics process can enterprises provide relevant logistics information to customers in the first time and improve customer satisfaction. Therefore, enterprises need to improve the logistics network, logistics facilities planning and setting, develop appropriate logistics strategy, effectively improve the level of logistics services, to build a more reasonable logistics system.

It is necessary for an enterprise to make an in-depth analysis of market competition. Competitors in the market influence the decision-making of supply chain network design. Faced with existing competitors, new entrants must occupy a certain market share through competition, to maximize the whole profits of supply chain network. If enterprises ignore the potential influence of external competition, their profit forecast and network design will have serious deviation. In the study of Supply Chain Network Design (SCND), most models only consider a single Supply Chain and ignore the influence of competitor Supply Chain. Therefore, it is significant to consider the problem of supply chain network optimization design under oligopoly competition. Past research analyzed the equilibrium state of market competition and aimed to build a supply chain network model from the strategic and operational levels, seeking the profit maximization of new entrants. In all, market competition is a key issue in the process of supply chain design.

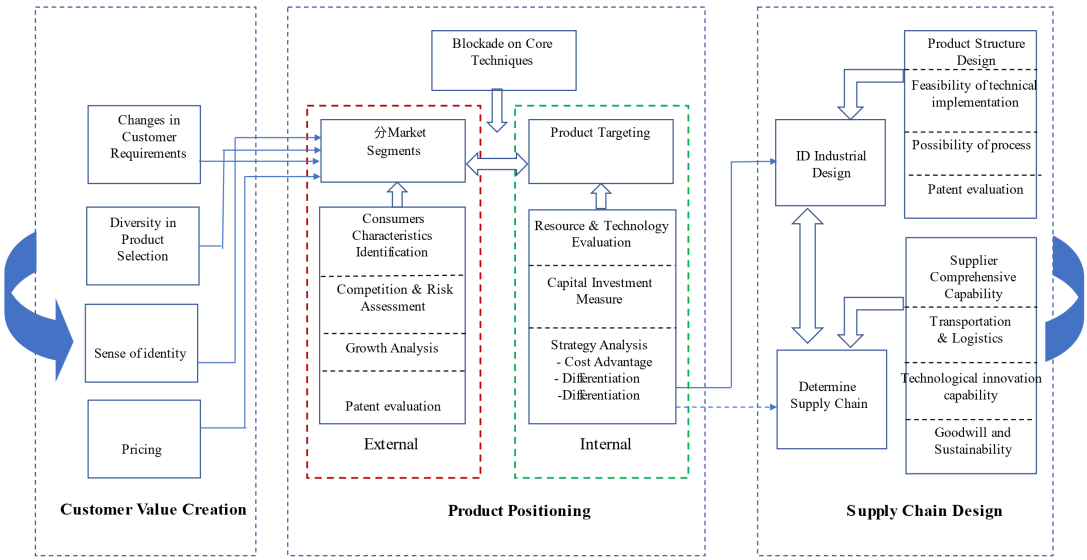


Figure 3-6 Theoretical Framework

The theoretical framework covers three main parts, including consumer value creation, product repositioning and supply chain strategy. Enterprises need to take consumer

value as a starting point to identify the change of customer needs and then complete market segmentation based on it. Combined with their own actual situation, enterprises need to determine the target product and company strategy. Finally, enterprises should identify the supply chain strategy and the whole structure, to achieve cost reduction and efficiency increase. As shown in the frame diagram, each link is interrelated and influences each other to form an organic whole The theoretical analysis of consumer value creation, product repositioning and supply chain strategy is of great significance for companies to explore how to develop new products and achieve profit maximization.

Chapter 4 Supply Chain Design Model

This thesis chooses LANSEA Company as a practical case. As a new entrant in the middle and high-end hair dryer market, the optimization design of the whole supply chain network is explored. At the same time, it is necessary to consider oligopolistic competition under different market conditions, and construct a two-layer supply chain network design model under oligopolistic competition. At present, the domestic high-end hair dryer market, the main products include Dyson, AIRFLY, REPRONIZER and other different brands of hair dryer. This kind of products meet the needs of some consumer groups in the domestic market because of its function and brand advantages. However, LANSEA as a domestic emerging hair dryer product, also positioned in this high-end market. It has already set up production plants, distribution centers and retailers in the country, with the aim of occupying this segment of the Chinese market. As a new entrant in the domestic market, LANSEA needs to consider the game problem with existing competitors in the market, and determine the product pricing, service level and other factors of the competitors. Combined with the demand and cost conditions of each manufacturer in the market, we explore the manufacturer's maximum profit under the competitive equilibrium situation. For a number of foreign candidate markets, their own manufacturers need to consider not only the competitive game problem in the market, but also the decision-making problem of determining each node of the supply chain network. Different from the domestic market, for any candidate foreign market, LANSEA needs to decide whether to establish a local distribution center, establish a retailer and enter the market by combining market competition conditions, supply link cost, overall production capacity and distribution capacity. By establishing a two-layer supply chain network design model, the strategy and operation level decisions are determined, so as to achieve the overall profit maximization of the manufacturer.

Combined with practical problems, this thesis mainly explores how to optimize the network design of the entire supply chain under the oligopolistic competition, so as to maximize the total profits of manufacturers in multiple markets. Considering a two-tier supply chain network model, the manufacturer needs to select several foreign markets as candidate markets and build a game model under Nash equilibrium condition according to the game situation of all competitors in the market, so as to complete the decision-making at the operational level, that is, determine the product pricing, service level and other factors under equilibrium conditions. On this basis, manufacturers need to complete the internal supply chain network design issues related to the decision, including the selection of candidate market entry, the establishment of local distribution center, etc. Complete strategic policies around each component of the supply chain, so as to determine the layout of facilities in the entire supply network, including production plants, distribution centers, retailers and end markets. At the same time, it is necessary to consider the maximum production capacity of the production plant and the distribution capacity of the local distribution center and other restrictions, so as to seek the maximum profit of their own manufacturers under the oligopolistic competition. Relevant decision variables are analyzed: the decision of external operation level is short-term and easy to adjust decision variables, including product price and service level, etc. Internal decisions, including the establishment of distribution centers and retailers, are basically fixed facility deployment decisions. This problem needs to consider the unit product cost, carrying cost and corresponding market sales in the supply link. The final decision of supply chain network design is determined based on the facility cost of distribution center and retailers. Therefore, manufacturers need to consider the actual competition situation of each market, complete the supply chain network design from a global perspective, and determine the optimal solution of the whole problem.

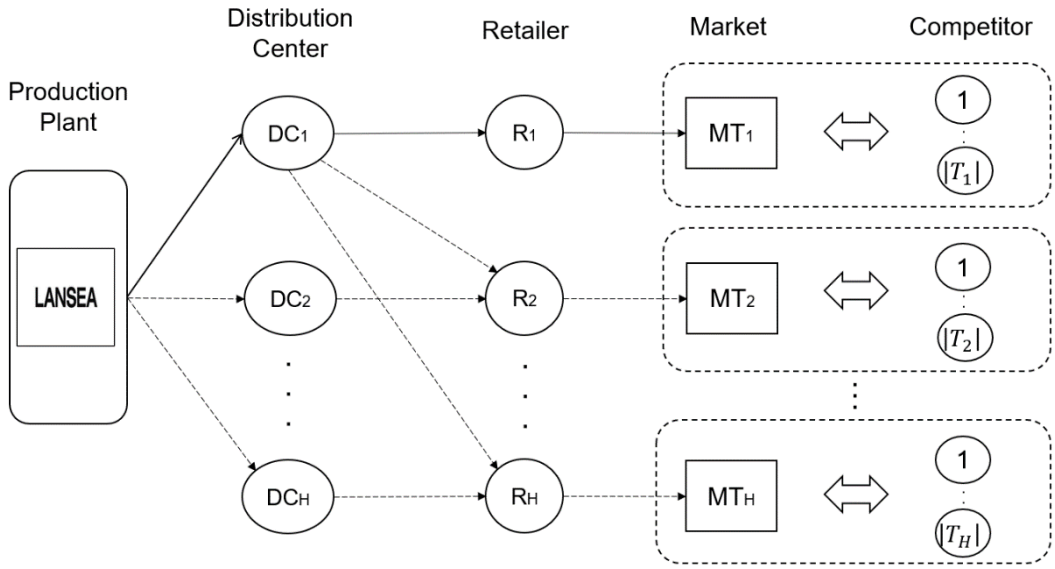


Figure 4-1 Supply Chain Network Design under Oligopolistic Competition

Based on the case of LANSEA, the design model of supply chain network under oligopolistic competition is constructed in this thesis. In the two-layer model, the outer model mainly considers the competitive game problem under each market, and determines several decision variables at the operation level. As for the interior, the model needs to complete the selection of facilities in each link of the supply network to achieve the optimal design of the network. As shown in Figure 4-1, the whole supply chain network covers four links, including production plants, distribution centers, retailers and end markets. The right section of the figure depicts competition in each market. In the supply chain network model, MT_1 corresponds to the local market, where the manufacturer has identified the supply node, including production factories, distribution centers, retailers and other facilities. In any candidate market MT_h, it is necessary to decide whether to establish a corresponding retailer and distribution center. If it is confirmed to enter a certain competitive market, the manufacturer can choose to build its own distribution center or choose DC_1 in the local market to complete the product supply. The solid lines in the graph correspond to the determined supply paths and the dotted line corresponds to the network link of the supply chain to be confirmed.

Each link involved in the supply chain network is described in detail as follows: As for the production plant LANSEA, it is only located in the local market MT_1, and the plant layout in other candidate markets is not considered. For the distribution center DC_h, if it is determined to be established in the market MT_h, the product is shipped directly to the local distribution center through the production plant and handed over to the corresponding retailer R_h. Conversely, local distribution center DC_1 supplies products. For R_h, if the retailer chooses to establish in MT_h, the manufacturer will participate in the competitive game of the market. For any competitive market, there are several existing players competing with new entrants.

In the design model of two-layer supply chain network, it mainly includes two parts: (1) The external model analyzes the dynamic competition between the new entrants and the existing manufacturers, and determines the product price and service level of each manufacturer under the equilibrium condition by solving the Nash equilibrium situation. (2) The internal model is an integer programming problem about supply chain network planning, and the facility layout of each link is determined according to the optimal solution obtained. For this network design problem, the internal and external models are interrelated. The external competitive game problem determines the factors such as market demand and price under the equilibrium condition, provides specific variables for the objective function of the subsequent supply chain network design, and then completes the profit solution of the whole supply network. The design of the internal supply chain network, namely the layout of facilities, will affect the overall supply cost of unit product, and then affect the equilibrium price and service level under the market game. Different from the general supply chain network design model, this thesis considers the influence of competitors, an important factor in the market, and completes the supply chain network design from two aspects of strategy and operation, so as to obtain the overall profit maximization of new entrants.

4.1 Oligopolistic competition

In the two-tier supply chain network model, the oligopolistic competition involving new entrants in a specific market should be considered externally. For any candidate market MTh, new entrants need to analyze the competition situation of existing competitors, including product demand, unit product supply cost and carrying cost of competitors. According to the competitive game model, the variables of each competitor under the equilibrium condition are determined under any candidate market, including the service level, product pricing and market demand of each competitor. In this model, the design of the internal supply chain network also affects the manufacturer's own unit product supply cost, and thus affects the operation decision of the manufacturer in a specific market. On the other hand, the relevant indicators obtained from the analysis of oligopolistic competition should also be applied to the internal supply chain network optimization model to solve the maximum profit of their own manufacturers. For oligopolistic competition in several markets, this model applies the market demand function proposed by Bernstein and Federgruen, and on this basis analyzes the game problems of multiple competitors in the same market. Suppose that there are N competing manufacturers in a certain market, and the products provided by each manufacturer are different to some extent and face random consumer demands. This thesis assumes that for any manufacturer S_i, the selling price of its products is p_i and the service level of its products is f_i. Among them, service level f_i refers to the probability that the manufacturer's inventory can meet the market demand, which can also be interpreted as the manufacturer's product supply capacity in a certain market. This thesis mainly explores the market game under oligopoly competition, so as to determine each solution of equilibrium condition. Without loss of generality, it is assumed that the service level of the manufacturer in this problem is set to the range [0.5,1). For any manufacturer S_i, it is assumed that the product demand D_i in a specific market is a function of the product price and service level of all competitors, and is a random variable in product form. The expression is as follows:

$$D_i(\boldsymbol{p},\boldsymbol{f}) = d_i(\boldsymbol{p},\boldsymbol{f})\,\epsilon_i,\ \ \forall i = 1,2,\cdots,N \tag{4-1}$$

Among them, ϵ_i is continuous random variables, and independent of all manufacturer's product price and the service level of a variable. At the same time, for any i, random variable ϵ_i should satisfy the equation of $E(D_i) = d_i(p,f)$. In the oligopolistic competition problem, the model assumes that the average demand $d_i(p,f)$ of the firm S_i is a linear function of price and service level. Assume that all relevant parameters are positive and each monotone requirement above is satisfied. The expression is as follows:

$$d_i(p,f) = a_i - b_i p_i + \sum_{j\neq i} c_{ij}\,p_j + \beta_i f_i - \sum_{j\neq i} \gamma_{ij} f_j,\ \ \forall i = 1,2,\cdots,N \tag{4-2}$$

The demand function shows that the market demand of any manufacturer S_i decreases with the increase of its own product pricing and increases with the increase of competitors' product prices. When the service level of its own is improved, the corresponding market demand will increase; when the service level of its competitors is improved, the demand of its own manufacturers will decrease. For any manufacturer S_i in a competitive market, it is assumed that its unit product supply cost is ω_i, including product production cost, transportation cost and holding cost. For the retail link of the manufacturer, it is assumed that the unit product inventory carrying cost is h_i^+ and the unit product backlog cost is h_i^-. The corresponding total carrying cost is positively correlated with the total amount of remaining inventory at the end of the period, and the total backlog cost is proportional to the number of uncompleted orders. In this problem, considering the actual sales situation of the product, the final model does not consider the backlog cost caused by unfulfilled orders. In the actual market, a large proportion of retailers will choose to prepare a certain amount of safety inventory, so as to ensure the completeness of the supply link. Meanwhile, suppose the inventory

level decided by the corresponding retailer is y_i, then for any manufacturer S_i, the profit function of the whole supply link is:

$$\pi_i(p, f, y_i) = (p_i - \omega_i)d_i(p, f) - h_i^+ \mathrm{E}[y_i - D_i(p, f)]^+ - h_i^- \mathrm{E}[D_i(p, f) - y_i]^+ \quad (4\text{-}3)$$

Taking into account the definition of supply service level, the inventory level determined by the retail link needs to meet a certain quantity limit with the actual market demand, which is expressed as follows:

$$Pr[D_i(p, f) \le y_i] \ge f_i \quad \Rightarrow \quad Pr\left[\epsilon_i \le \frac{y_i}{d_i(p, f)}\right] = G_i\left(\frac{y_i}{d_i(p, f)}\right) \ge f_i$$

$$\Rightarrow \; y_i \ge \; d_i(p, f)\; G_i^{-1}(f_i) \quad (4\text{-}4)$$

Therefore, according to the above conditional constraints on product pricing and service level, the operation decision of any manufacturer S_i should meet the following conditions:

$$\left\{(p_i, f_i, y_i): p_i^{min} \le p_i \le p_i^{max}; 0.5 \le \; f_i \le 1; y_i \ge \; d_i(p, f)\; G_i^{-1}(f_i)\right\} \quad (4\text{-}5)$$

In order to solve the overall profit function, an appropriate inventory level y* is determined when product price and service level are fixed, so as to maximize the overall profit of the manufacturer. After calculation, it is obtained that:

$$y_i = \; d_i(p, f)\; G_i^{-1}\left(\frac{h_i^-}{h_i^+ + h_i^-}\right) \quad (4\text{-}6)$$

Combined with the constraints of the manufacturer's service level, the optimal order quantity y_i* of any retailer under given conditions is:

$$y_i^*(p,f) = d_i(p,f)\, G_i^{-1}\left(max\left\{f_i, \frac{h_i^-}{h_i^+ + h_i^-}\right\}\right) \tag{4-7}$$

On this basis, the final simplified profit function expression is obtained:

$$\pi_i(p,f) = \big(p_i - \omega_i - k_i(f_i)\big)d_i(p,f) \tag{4-8}$$

The function $k_i(f_i)$ is as follows:

$$k_i(f_i) = h_i^+ \mathrm{E}\left[G_i^{-1}\left(max\left\{f_i, \frac{h_i^-}{h_i^+ + h_i^-}\right\}\right) - \epsilon_i\right]^+ + h_i^- \mathrm{E}\left[\epsilon_i - G_i^{-1}\left(max\left\{f_i, \frac{h_i^-}{h_i^+ + h_i^-}\right\}\right)\right]^+ \tag{4-9}$$

It should be noted that the $k_i(f_i)$ function refers to the portion of the cost to be consumed per unit of product inventory at a particular level of service. This simplified profit model is equivalent to the oligopolistic competition model under certain demand and cost conditions.

Introduce the logarithmic form of the profit function. It is proved that the logarithmic function is a joint concave function of product price and service level based on the hypothesis of competition problem. The specific expression is as follows:

$$\log\big(\pi_i(p,f)\big) = \log\big(p_i - \omega_i - k_i(f_i)\big) + \log\big(d_i(p,f)\big) \tag{4-10}$$

On this basis, combined with the property of joint concave function, we can use the first-order condition to calculate the equilibrium index of competitive game problems in a specific market:

$$\frac{\partial \log\left(\pi_i(p,f)\right)}{\partial p_i} = \frac{1}{\left(p_i - \omega_i - k_i(f_i)\right)} - \frac{b_i}{d_i(p,f)} = 0 \qquad (4\text{-}11)$$

$$\frac{\partial \log\left(\pi_i(p,f)\right)}{\partial f_i} = \frac{-k_i'(f_i)}{\left(p_i - \omega_i - k_i(f_i)\right)} + \frac{\beta_i}{d_i(p,f)} = 0 \qquad (4\text{-}12)$$

According to the above formula, the operation decision relation under equilibrium condition can be obtained:

$$2b_i p_i - \sum_{j \neq i} c_{ij}\, p_j = a_i + \left(\beta_i f_i - \sum_{j \neq i} \gamma_{ij} f_j\right) + b_i\left(\omega_i + k_i(f_i)\right), \quad \forall i = 1, 2, \cdots, N \qquad (4\text{-}13)$$

Combining the two equations, we can get:

$$k_i'(f_i) = \frac{\beta_i}{b_i}, \quad \forall i = 1, 2, \cdots, N \qquad (4\text{-}14)$$

After solving the external model, that is, determining the operational decision under oligopoly competition, it is necessary to consider the optimization design of the entire supply chain network. Under different conditions, according to the determined equilibrium demand and corresponding profit level, the model needs to select appropriate nodes from different supply links to determine the optimal supply chain network structure, so as to maximize the overall profit.

4.2 Optimization objective

The whole supply chain network consists of production plants, distribution centers, retailers and end markets. Among them, each terminal market needs to consider the competition game of each manufacturer in the market. After obtaining the equilibrium

demand and product profit under given conditions, the manufacturer is responsible for making the following decisions on supply chain network design:

- Whether to establish a retailer in the candidate market, if so, enter the market for competitive game;
- Whether a local distribution center is established in the supply chain and, if so, the factory ships the product directly to that market;
- Product pricing and service level of the manufacturers in the candidate markets.

Analyzing the total cost of the product along the supply route takes into account unit production costs at the factory, transportation costs from the factory to the designated distribution center, carrying costs at the distribution center, and ultimately transportation costs to the retailer. Determine the cost of entering a candidate market MT_h and setting up a retailer in the local market as D_h. After entering the local market, the manufacturer's own distribution center costs R_h. After entering the market and participating in the competition game, the determined product pricing and service level are p_h and f_h, respectively. The manufacturer needs to determine the optimal supply chain network design, product pricing and service level to maximize the overall profit, including the total profit of the products in the local market and the newly entered candidate market. The expression is as follows:

$$MAX\ \Pi = \ Profit\ (MT_1) + \sum_{h=2}^{H} Profit\ (MT_h) \qquad (4\text{-}15)$$

4.3 Assumptions and Constraints

In this model, different candidate markets have different demand functions for products from the same manufacturer due to regional differences. The amount of benchmark demand for products varies in different candidate markets. The effect of product price and service level is also different. For any candidate market MT_h, there are generally first-entrant firms, so firms need to consider oligopolistic competition in subsequent

decision-making. In the same candidate market, the amount of benchmark demand for products from different vendors generally varies. There is no correlation between market consumers' pricing of different manufacturers and demand elasticity of service level. In each market, competition among different manufacturers is assumed to be a Nash equilibrium problem, that is, N competitors need to make decisions on product price and service level at the same time, so as to maximize their own profits. The manufacturer's own market demand d_h not only needs to consider the impact of its own operational decisions, but also changes due to competitors' pricing and service level changes. It is assumed that there are pre-entrants in any candidate market, that is, the situation of complete monopoly market is not considered.

In its home market, LANSEA has established production facilities, distribution centers and retailers connected to the local market. In other candidate markets, the vendor has at most a distribution center and retailer. If the manufacturer decides to enter a certain market MT_h, it must establish a corresponding retailer R_h locally. However, manufacturers can choose to set up local distribution center DC_h or supply products with the help of local distribution center DC1. The issue of product availability between new market entrants is not considered in this issue. In this model, if the factory capacity cannot meet the product demand d_h of a certain market, the entry into this market is abandoned. At the same time, if the firm determines to enter a candidate market, the required factory capacity is equal to the equilibrium demand quantity under the market. For any candidate market, the unit product supply cost is assumed to be ω_{h1} under the condition of the distribution center built by the manufacturer, and the supply cost is ω_{h0} when the local distribution center is selected, and $\omega_{h1}<\omega_{h0}$ in general.

Considering the constraints of oligopoly competition and supply chain network design, combined with practical cases, this model mainly introduces the following constraints:

- Constraints on maximum factory capacity. In a period of time, the maximum supply

quantity of the factory C_{max}, that is, the upper limit of the total demand of the manufacturer for products in various markets.

- Distribution capacity constraints. For the distribution center in the local market, the maximum number of products in stock H_{max} is required, which requires the candidate market to have a certain limit on the number of products transported by the distribution center.
- Facility layout constraints. In order to enter a candidate market, a firm must establish a local retail presence. On the contrary, if the participation in a market competition is not considered, the decision to establish distribution centers and retailers is given up.
- Price and service level restrictions. Considering the model design under oligopoly competition, the decision about firm operation in the problem needs to be determined according to the Nash equilibrium condition under the game.

4.4 Model characteristics

In this thesis, the design model of supply chain network under oligopolistic competition is constructed by taking LANSEA as a reference example. Considering the decision of operational variables under the competitive game problem, on this basis to complete the supply chain network facilities selection, so as to achieve the optimal design of the network. Different from the traditional supply chain network design problem, this study has the following characteristics:

- This thesis explores the design of two-layer supply chain network: the external model determines the equilibrium product pricing and service level under given conditions by solving the oligopolistic competition problem. Internal combination of the above operational variables, through the distribution center, retailers and other links layout decisions to determine the optimal results of the supply network.
- In this thesis, we consider the two solutions of self-built distribution center or product distribution through the local market, which is more in line with the layout

decision of the manufacturer for the new market.

- Traditional supply chain network design focuses on the optimization of facility location. This thesis introduces the product supply cost, simplifies the index calculation of the supply network link, and focuses on the selection of new market and the establishment of distribution center.

4.5 Mathematical model

Combined with the above research on oligopoly competition and supply chain network design, this thesis considers the problem modeling of the general case, and constructs the following integer programming model:

$$\max_{x_h, y_h, p_{h_i}, f_{h_i}} \Pi = \left[(p_1 - \omega_1 - k_1(f_1))d_1 - D_1 - R_1\right] \sum_{h=2}^{|H|} y_h \left\{x_h \left[\left(p_{h_1} - \omega_{h_1} - k_h(f_h)\right) d_{h_1} - x_h D_h - y_h R_h\right] + (1 - x_h)\left[\left(p_{h_0} - \omega_{h_0} - k_h(f_h)\right) d_{h_0} - x_h D_h - y_h R_h\right]\right\} \quad (4\text{-}16)$$

$s.t.$

$$d_1 + \sum_{h=2}^{H} y_h \left[x_h d_{h_1} + (1 - x_h) d_{h_0}\right] \leq C_{max} \quad (4\text{-}17)$$

$$\sum_{h=2}^{H} y_h (1 - x_h) d_{h_0} \leq H_{max} \quad (4\text{-}18)$$

$$2b_{h_i} p_{h_i} - \sum_{h_j \neq h_i} c_{h_i h_j} p_{h_j} = a_{h_i} + \left(\beta_{h_i} f_{h_i} - \sum_{h_j \neq h_i} \gamma_{h_i h_j} f_{h_j}\right) + b_{h_i}\left(\omega_{h_i} + k_{h_i}(f_{h_i})\right) \quad (4\text{-}19)$$

$(\forall h_i \in T_h^{total}, \forall h \in H)$

$$x_h \leq y_h \qquad (\forall h \in H) \quad (4\text{-}20)$$

$$x_h, y_h \in \{0,1\} \qquad (\forall h \in H) \quad (4\text{-}21)$$

The symbols in the expression have the following meanings.

Decision variables

x_h	If distribution center h is used for supply chain network design, then it is 1, otherwise it is 0
y_h	If the retailer h chooses to enter the market competition, then it is 1; otherwise, it is 0
f_h	Service level of products supplied after entering MT_h
p_h	Pricing of products after entering MT_h

Sets and parameters

H	A collection of candidate markets for products $H = \{1, 2, \cdots, \|H\|\}, h \in H$
T_h	Competitors that have entered MT_h
T_h^{total}	All vendors in Market h (including new entrant LANSEA)
D_h	The cost of establishing a distribution center in market h
R_h	The cost of establishing a retailer in market h
ω_h	In market h, the cost per unit product for the entire supply path
h_0	In market h, DC_1 is selected as the distribution center to supply products
h_1	Select self-built distribution center in market h to complete product supply
C_{max}	Maximum capacity of LANSEA
h_i	A competitor i in MTh

Expression (11) is the objective function of the integer programming model corresponding to the supply chain network design problem under oligopoly competition. The optimization objective is to maximize the total profit of the whole supply chain network. The target equation consists of two parts, including the local market and the profits of all new products entering the market. Constraint (12) ensure that the production capacity of LANSEA manufacturer can meet

balanced product demand of each candidate market. Restriction (13) ensure that the inventory holding of the distribution center in the home market does not exceed its upper limit, i.e. the sum of products shipped to each candidate market does not exceed its maximum distribution range. Constraint condition (14) determines the

interrelationship of operational decisions of each firm under competitive equilibrium. The restriction (15) ensures that the retailer and distribution center are placed in a sequential order in the supply chain. If a vendor does not choose to enter a candidate market, it will not consider setting up a distribution center there.

Chapter 5 Construction of Supply Chain: A Field Study

5.1 Background of LANSEA Corporation and Key Issues

This thesis chooses LANSEA, an emerging domestic hair dryer manufacturer, as a case firm to explore how to construct a supply chain for newly introduced products.

LANSEA is an emerging hair dryer manufacturer in China, founded in 2016. With high-speed frequency conversion motor and bladeless technology as its core competitiveness, LANSEA is positioned in the Medium-high end functional hair dryer, aiming to occupy a certain share of various market segments.

In recent years, the development of the small home appliance industry is accelerating, and the market demand for all kinds of small home appliance products is constantly upgrading. As an important member of small household appliances, hair dryer is also facing rising consumer demand. Small household appliances generally refer to electrical appliances that occupy relatively small power resources, which can provide consumers with a softer and more comfortable life and effectively improve the quality of people's life. According to function classification, hair dryer belongs to personal life small household appliances. The use of such products requires close contact with the personal body. Therefore, it generally has a higher standard of safety and accuracy, which also puts forward higher requirements for product functionality, user experience and product quality. According to the product and market maturity of the division, hair dryer is still in the growth stage. Related product function, quality and other aspects still have a large space for development. Overall, all types of small household appliances are optional consumer goods. The purpose of use is to improve the quality of life, enhance the comfort experience and so on. However, with the steady growth of social economy, people's consumption ideas in different countries have been adjusted. Especially with the increase of the size of the middle-income group, some small

household appliances have gradually taken on the attribute of necessity. Overall demand for mid - and high-end hair dryer products such as LANSEA is also rising. In addition, with the innovation of hardware and software technology of small household appliances and the continuous mining of consumer demand, the number of small household appliances is still growing globally. In some countries, the small household appliance industry is still in the growth or introduction period. At the same time, with the improvement of per capita consumption level and the change of population age structure, small household appliances will gradually transform into daily necessities. In recent years, Chinese residents' health expenditure has increased rapidly, which also reflects the increasing attention of consumers to health maintenance. Medium and high-end hair dryer has more obvious advantages in health care by virtue of its functional completeness. It is also in line with the technical innovation direction of health-oriented small household appliances, which can effectively improve the quality of life of customers. At the same time, it also fully realizes the upgraded product demand of consumer groups. From the perspective of the development law of small household appliance industry, the transformation is generally completed in accordance with the steps of labor, electrical appliance introduction, electrical appliance popularization and product upgrading. Present, all kinds of small household appliances in our country are still in guiding period. There is still a big gap between the penetration rate of many small household appliances and that of developed countries. Several developing countries are also at this stage of electrical appliance introduction. Therefore, in the long run, the penetration rate of all kinds of small household appliances is expected to continue to rise. For LANSEA, a medium and high-end hair dryer product, the potential market demand will be at a relatively high level due to consumption upgrading and other driving factors.

At present, consumption upgrading has become the development trend of many regional markets. Consumption upgrading generally refers to the upgrading of

consumption structure, reflecting the overall improvement of consumption levels. This has also significantly increased the market demand for middle and high-end consumer goods. LANSEA is also an important product under the background of consumption upgrading. In the early stage of economic development, consumers in various countries pay more attention to the expansion of consumption scale and pursue the satisfaction of consumption quantity. When the income level of residents develops to a certain period, the masses pay more attention to the improvement of the quality and structure of consumption. Among them, the proportion of consumption belonging to the development and enjoyment type will increase correspondingly. Residents began to pursue higher quality consumer goods. From the perspective of demand side, due to the improvement of purchase level, consumer groups gradually pursue the middle and high-end small household appliances such as LANSEA, so as to improve the quality of life and enhance the product use experience. From the perspective of the supply side, with the development of the national economy, the industrial structure has been continuously improved, and it has a relatively continuous innovation ability, so as to improve the quality of consumer goods in various sectors. One of the most intuitive manifestations of the trend of consumption upgrading is the continuous increase in consumption. Take our country as an example. In recent years, the retail sales of all kinds of consumer goods such as household appliances, food, clothing, culture and sports have been growing continuously. Among them, the increase of home appliances industry is higher. This also fully reflects the small household appliances plate has a larger base of potential consumer demand. At the same time, the change in the structure of various consumer goods is also an important manifestation of consumption upgrading. In addition to meeting the basic needs of food, clothing, housing and transportation, the majority of residents began to pursue better consumption experience and services.

With the improvement of residents' income level, consumer groups have put forward higher requirements for the intellectualization and comfort of products. Overall

consumer demand is also gradually shifting from low-end goods to mid - to high-end products. For durable consumer goods, consumer groups in each region have a large scale of consumption. Take China as an example. In 2019, 96 washing machines and 115 air conditioners were owned by every 100 Chinese households. This data shows that consumer groups have a large consumption demand for household appliances and other major durable goods. At the same time, the consumption of durable goods is also developing towards the two directions of intelligence and comfort. Take color TV as an example. In recent years, with the iterative progress of technology, traditional TV has basically reached consumption saturation. Sales growth has remained at a low level. However, intelligent network TV improves the functionality and appearance experience of TV products, and promotes the upgrading pace of consumer demand. Similarly, Dyson hair dryers have upgraded their technology in the same category. Its intelligent temperature control system can play an effective role in protecting hair quality, and its sales have also shown a leapfrog growth in recent years. Among them, the middle-class group is the main consumer group. As the size of this crowd continues to expand, the user demand for LANSEA and other high-end hair dryer products will also increase accordingly. In terms of candidate markets, the consumption development trend in many regions is similar to our country. With the steady improvement of the overall level of the national economy, the product demand and purchasing power of consumer groups are also constantly upgrading. As a new entrant in the middle and high-end hair dryer market, LANSEA faces both opportunities and challenges in the market. It is particularly important for manufacturers to make operational and strategic optimization decisions to occupy a niche market.

5.2 Product Development: Customer Value Driven Approach

In order to occupy a position in the middle and high-end hair dryer market, LANSEA must consider the oligopolistic competition in this market segment. Dyson is undoubtedly one of the most competitive players in the same category. Dyson is a

British brand focusing on high-end home appliances, and its overall product strength has surpassed that of most Chinese home appliance brands. Among them, Dyson hair dryer in the high-end product market occupies a larger market share. The consumer portrait of the brand in our country basically conforms to the relevant characteristics of middle-class groups. This shows that through accurate product positioning, Dyson has attracted the favor of this consumer group, and gradually expanded its market share and total profit. The reason behind it is not only to meet the consumption needs of specific customer groups, but also closely related to the economic growth of the region. In a certain market, if the overall level of economic development continues to improve, it means that the overall purchasing power of residents also increases correspondingly. This is also an important basis for high-end consumption growth. In addition, with the expansion of the middle-income group, the rising middle class has become the main force of consumption. They put forward higher requirements for the quality of life. Under this changing trend, consumer demand also needs to be upgraded accordingly. As analyzed above, there are significant differences between this group and other groups in consumption preferences and habits. They pay more attention to product quality and individual expression, and are more willing to pay for high-quality goods and the corresponding brand premium. Compared with the average consumer, the elasticity of consumer demand of this group is relatively low. This also creates a better opportunity for the penetration of consumer groups in the middle and high end hair dryer products.

In order to become a new entrant in the middle and high-end hair dryer market, LANSEA has invested a lot of capital and manpower costs. It has developed a number of innovative technologies, including high pressure centrifugal fan banks, shock tube test wind tunnels and impulse turbines. LANSEA also has a full set of high-speed frequency conversion motor and aerodynamics related research and development, testing equipment. Since its establishment, it has obtained more than 460 national

patents. On this basis, LANSEA has realized the innovation and upgrading of products, and independently designed and manufactured various cutting-edge product components, including the engine, motor, sensor and parts of the core of the hair dryer. In order to fully upgrade products and meet the needs of consumers, LANSEA has not only developed cutting-edge product features, but also optimized product design to provide a more perfect user experience for consumers. In terms of product features, LANSEA has achieved breakthroughs in wind speed and volume with its high-speed variable frequency motor. LANSEA developed a three-layer Conda effect duct. With more precise temperature control, it speeds up hair drying and improves hair care. In terms of product design, the LANSEA also achieves a lighter handheld balance design, which completely changes the top-heavy hair dryer. At the same time, the LANSEA uses a quiet impeller design to minimize the mechanical noise of the digital motor, and even provides four types of air nozzle, which brings great convenience for users to achieve easy modeling. Therefore, this hair dryer of LANSEA has realized the innovation of product function and design, which brings more perfect function design and use experience for customers, and fully meets the upgrading needs of modern consumer groups.

LANSEA's H2 model uses Bernoulli's principle of fluid mechanics. An air flow with a wind speed of 0.49 Mach and a flow rate of 20L/S is formed at the handle by a high-speed rotating axial fan. The air passing through the airflow channel forms a negative pressure difference of 260pa in the airflow doubling area. In this way, the surrounding air will automatically flow from the high pressure region to the low pressure region in the direction of the pressure gradient in accordance with Bernoulli's principle of continuous fluid, which completes the air flow doubling. After doubling, the air flow rate reached 37.5L/S. After the doubling of the air flow through the subsonic duct speed regulation, adjust the direction, in the form of gathering through the outlet. At the outlet

position, the local wind speed is close to 50m/s, which can ensure that the effective blowing distance exceeds 10m.

5.3 Key Factors Influencing the Construction of the Supply Chain

In order to occupy a position in the middle and high-end hair dryer market, LANSEA must consider the oligopolistic competition in this market segment. Dyson is undoubtedly one of the most competitive players in the same category. Dyson is a British brand focusing on high-end home appliances, and its overall product strength has surpassed that of most Chinese home appliance brands. Among them, Dyson hair dryer in the high-end product market occupies a larger market share. The consumer portrait of the brand in our country basically conforms to the relevant characteristics of middle-class groups. This shows that through accurate product positioning, Dyson has attracted the favor of this consumer group, and gradually expanded its market share and total profit. The reason behind it is not only to meet the consumption needs of specific customer groups, but also closely related to the economic growth of the region. In a certain market, if the overall level of economic development continues to improve, it means that the overall purchasing power of residents also increases correspondingly. This is also an important basis for high-end consumption growth. In addition, with the expansion of the middle-income group, the rising middle class has become the main force of consumption. They put forward higher requirements for the quality of life. Under this changing trend, consumer demand also needs to be upgraded accordingly. As analyzed above, there are significant differences between this group and other groups in consumption preferences and habits. They pay more attention to product quality and individual expression, and are more willing to pay for high-quality goods and the corresponding brand premium. Compared with the average consumer, the elasticity of consumer demand of this group is relatively low. This also creates a better opportunity for the penetration of consumer groups in the middle and high end hair dryer products.

In order to become a new entrant in the middle and high-end hair dryer market, LANSEA has invested a lot of capital and manpower costs. It has developed a number of innovative technologies, including high pressure centrifugal fan banks, shock tube test wind tunnels and impulse turbines. LANSEA also has a full set of high-speed frequency conversion motor and aerodynamics related research and development, testing equipment. Since its establishment, it has obtained more than 460 national patents. On this basis, LANSEA has realized the innovation and upgrading of products, and independently designed and manufactured various cutting-edge product components, including the engine, motor, sensor and parts of the core of the hair dryer. In order to fully upgrade products and meet the needs of consumers, LANSEA has not only developed cutting-edge product features, but also optimized product design to provide a more perfect user experience for consumers. In terms of product features, LANSEA has achieved breakthroughs in wind speed and volume with its high-speed variable frequency motor. LANSEA developed a three-layer Conda effect duct. With more precise temperature control, it speeds up hair drying and improves hair care. In terms of product design, the LANSEA also achieves a lighter handheld balance design, which completely changes the top-heavy hair dryer. At the same time, the LANSEA uses a quiet impeller design to minimize the mechanical noise of the digital motor, and even provides four types of air nozzle, which brings great convenience for users to achieve easy modeling. Therefore, this hair dryer of LANSEA has realized the innovation of product function and design, which brings more perfect function design and use experience for customers, and fully meets the upgrading needs of modern consumer groups.

LANSEA's H2 model uses Bernoulli's principle of fluid mechanics. An air flow with a wind speed of 0.49 Mach and a flow rate of 20L/S is formed at the handle by a high-speed rotating axial fan. The air passing through the airflow channel forms a negative

pressure difference of 260pa in the airflow doubling area. In this way, the surrounding air will automatically flow from the high pressure region to the low pressure region in the direction of the pressure gradient in accordance with Bernoulli's principle of continuous fluid, which completes the air flow doubling. After doubling, the air flow rate reached 37.5L/S. After the doubling of the air flow through the subsonic duct speed regulation, adjust the direction, in the form of gathering through the outlet. At the outlet position, the local wind speed is close to 50m/s, which can ensure that the effective blowing distance exceeds 10m.

5.4 Construction of the supply chain: model and simulation

In this model, the manufacturer needs to make a decision about the supply source of the product. Manufacturers can choose to set up a local distribution center DC_h while establishing a retailer in the new market MT_h. Manufacturers can also supply products through the distribution center DC_1 in the local market. In this case, it is assumed that the distribution center DC_1 has distribution capability limitation, that is, the total demand of products supplied by the manufacturer through DC_1 cannot exceed the upper limit. Through some transformation, the original model can be transformed into the following form:

$$\max_{x_h, y_h} \Pi = k_{1_1} + \sum_{h=2}^{|H|}\left[x_h\left(k_{h_1} - k_{h_0}\right) + y_h k_{h_0}\right] \tag{5-1}$$

$s.t.$

$$d_1 + \sum_{h=2}^{|H|}\left[x_h\left(d_{h_1} - d_{h_0}\right) + y_h d_{h_0}\right] \le C_{max} \tag{5-2}$$

$$\sum_{h=2}^{|H|}\left(y_h d_{h_0} - x_h d_{h_0}\right) \le H_{max} \tag{5-3}$$

$$k_{h_l} = \left(p_{h_l} - \omega_{h_l} - k_h(f_h)\right) d_{h_l} - x_h D_h - y_h R_h \qquad for\ l = 0, 1 \tag{5-4}$$

$$x_h \le y_h \qquad (\forall h \in H) \tag{5-5}$$

$$x_h, y_h \in \{0,1\} \qquad (\forall h \in H) \tag{5-6}$$

In this simplified integer programming model, the product form of decision variables is eliminated by both objective function and constraint. According to the existing assumptions, if the manufacturer confirms to enter a market, it needs to establish a local retailer, but can choose to build or borrow distribution center; On the other hand, if the manufacturer does not consider becoming a new entrant in the market, then it does not establish any facilities in the local market. Combined with the above relationship, the variables in product form can be simplified into decision variables about the establishment of distribution center. After transformation, the nonlinear variables in the original mathematical model are reduced to a single integer variable of 0-1. Considering the general scale supply chain network design problem, the integral linear programming model can be solved by using the programming software Gurobi.

This experiment mainly explores the optimal supply network design under oligopoly competition. Any candidate market is assumed to have an early entrant competitor. When their own manufacturers consider entering a certain market, they need to obtain their respective market demand and profit under the equilibrium condition by solving relevant conditions. This experiment needs to consider the specific decision-making problems of new market entry and facility establishment in combination with the operational variables of external competitive markets. Based on the construction of supply chain network design model under oligopoly competition, this thesis proposes numerical experiments on supply chain network design problems combined with LANSEA case background. The specific supply chain network is shown in the figure below:

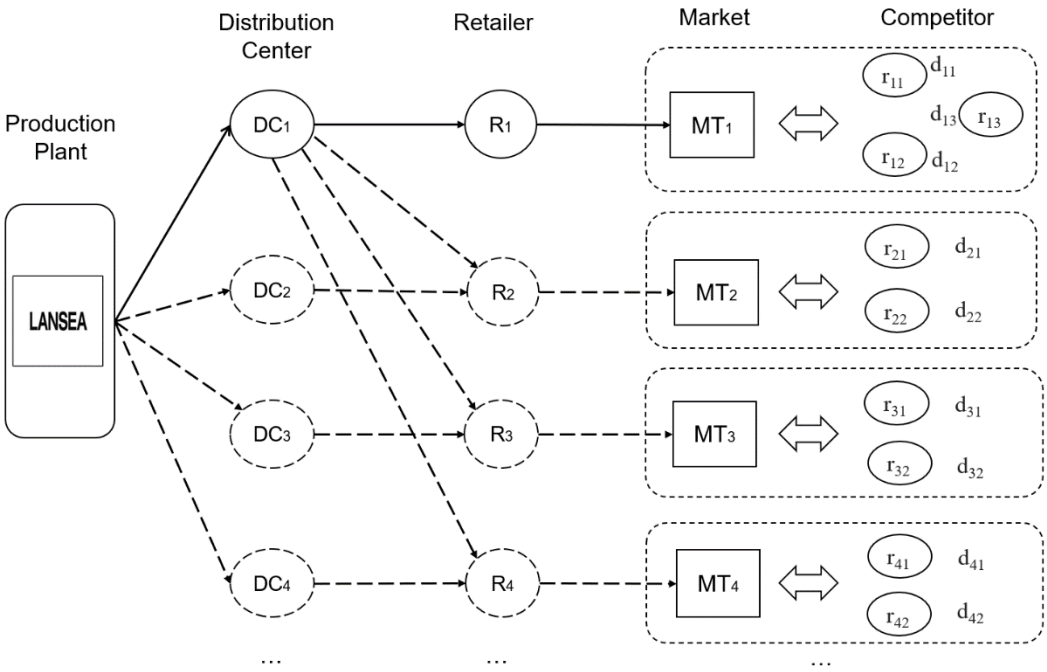


Figure 5-1 Numerical Experiment of SCND under Oligopolistic Competition

This experiment mainly explores the optimal supply network design under oligopoly competition. It is assumed that there are pre-entry competitors in any candidate market. When the manufacturer considers to enter a certain market, it needs to solve according to relevant conditions to obtain the respective market demand and profit under the equilibrium condition. At the same time, it is necessary to consider the operational variables of the external competitive market and the specific decision-making problems of the new entry market and the establishment of the facility. Combined with the actual case, it is assumed that the local market has established a local retailer R_1 and distribution center DC_1, and the production factory is responsible for the supply of products at the starting point. Transport to the local market MT_1 through the above supply path. Meanwhile, the manufacturer needs to consider the game problem with other first entering manufacturers, namely competitors r_{11}, r_{12} and r_{13}. The corresponding demand function is assumed to be d_{11}, d_{12} and d_{13}. Four candidate markets were considered in this experiment, namely MT_2, MT_3, MT_4 and MT_5. It is assumed that there are two first-entry competitors in any candidate market MT_h, namely r_{h1} and r_{h2}. The corresponding market demand is d_{h1} and d_{h2}. In the candidate market

MT_h, the manufacturer needs to decide whether to establish the retailer R_h and distribution center DC_h in the local market. If it is confirmed to enter a certain market for competition, the manufacturer can choose to build its own distribution center to complete product supply, or carry out transportation through the distribution center DC_1 in the local market. Manufacturers need to solve competitive problems in each market and make operational decisions. According to the plant capacity, candidate market demand and other conditions, the research can analyze the new market to enter. At the same time, relevant operational variables under different supply routes should be considered to complete the decision on the establishment of distribution centers, retailers and other facilities. Assume that the production plant in question has a maximum capacity of 40 and the distribution center in the local market has a maximum distribution ceiling of 30. For the local market MT_1, there are already three first-movers. Assume that the product demand of LANSEA in this market is d_{14}, and the market demand function of all manufacturers is as follows:

$$d_{11}(p,f) = 45 - 7p_1 + 2p_2 + 3p_3 + p_4 + 6f_1 - f_2 - f_3 - f_4$$

$$d_{12}(p,f) = 12 + 2p_1 - 6p_2 + p_3 + p_4 - f_1 + 10f_2 - f_3 - f_4$$

$$d_{13}(p,f) = 16 + 3p_1 + p_2 - 8p_3 + 2p_4 - 2f_1 - f_2 + 13f_3 - f_4 \quad d_{14}(p,f) = 20 + 3p_1 + p_2 + p_3 - 7p_4 - 2f_1 - f_2 - f_3 + 10f_4$$

As in numerical experiment 1, it is assumed that any random variables obey normal distribution. Conditions need to meet $\epsilon_i \sim N(1,\ 0.3^2)$. Given relevant parameters as follows: For unit product supply cost, $(\omega_1, \omega_2, \omega_3, \omega_4)$ = (7, 4, 6, 4.8);For the unit product carrying cost, $(h_1^+, h_2^+, h_3^+, h_4^+)$ = (1, 3, 2, 2). Combined with the actual problem of order performance, it is assumed that the manufacturer's order backlog cost is 0. By combining the competitive equilibrium model with the above parameters, the equilibrium service level and product pricing of each competitor can be obtained:

$$f^* = (0.80,\ 0.67,\ 0.79,\ 0.75)$$
$$p^* = (10.26, 6.67,\ 8.03,\ 7.64)$$

After substituting the competition problem, the corresponding product demand and profit are 16.43 and 38.58 respectively. For any candidate market, there are two first entrants. To simplify the problem description, MT2 is selected as an example. In this market, it is assumed that the demand function of LANSEA is d_{23}, and the related demand relation is as follows:

$$d_1(p,f) = 35 - 6p_1 + p_2 + 2p_3 + 5f_1 - f_2 - f_3$$
$$d_2(p,f) = 12 + 2p_1 - 7p_2 + p_3 - 2f_1 + 10f_2 - f_3$$
$$d_3(p,f) = 15 + 3p_1 + 2p_2 - 5p_3 - 2f_1 - f_2 + 12f_3$$

Among them, the unit supply cost of each manufacturer is: （$\omega_1, \omega_2, \omega_{31}$）= (7, 4, 7); For the retail side of the product carrying cost,（h_1^+, h_2^+, h_3^+）= (1, 3, 3). Similarly, it is assumed that each vendor can fulfill the backlog, regardless of its cost loss. Among them, ω_{31} refers to the sum of the supply cost of each link in the selection of local self-built distribution center. The corresponding cost of supplying by local distribution center is ω_{32} and assume ω_{32} = 7.2. In addition, the cost of setting up a retailer and distribution center in the candidate market MT_2 is 0.5 and 0.35, respectively. Combined with the above conditions and actual situation, it can be solved that the market profit of product supply completed by DC_2 and DC_1 is 9.93 and 8.95, respectively. After solving the oligopoly competition problem, the demand and profit of each candidate market under different supply paths are obtained. Combined with the supply chain network design model established above, the objective function can be determined to seek the maximum total profit of each market. According to the simplified optimization model, the example is transformed into the optimal solution for the corresponding integer linear programming problem under the condition that the factory capacity constraint C_{max} and

the distribution capacity constraint H_{max} are satisfied. Combined with the above conditions, Gurobi is used to solve the model to obtain the optimal supply chain network design. The specific path is shown in Figure 5-2. According to the optimal supply network design obtained from the solution, LANSEA will participate in the market MT_3, MT_4 and MT_5 as a new entrant on the basis of completing the supply in the local market. According to the product demand under competitive equilibrium, the manufacturer chooses not to enter the candidate market MT_2.

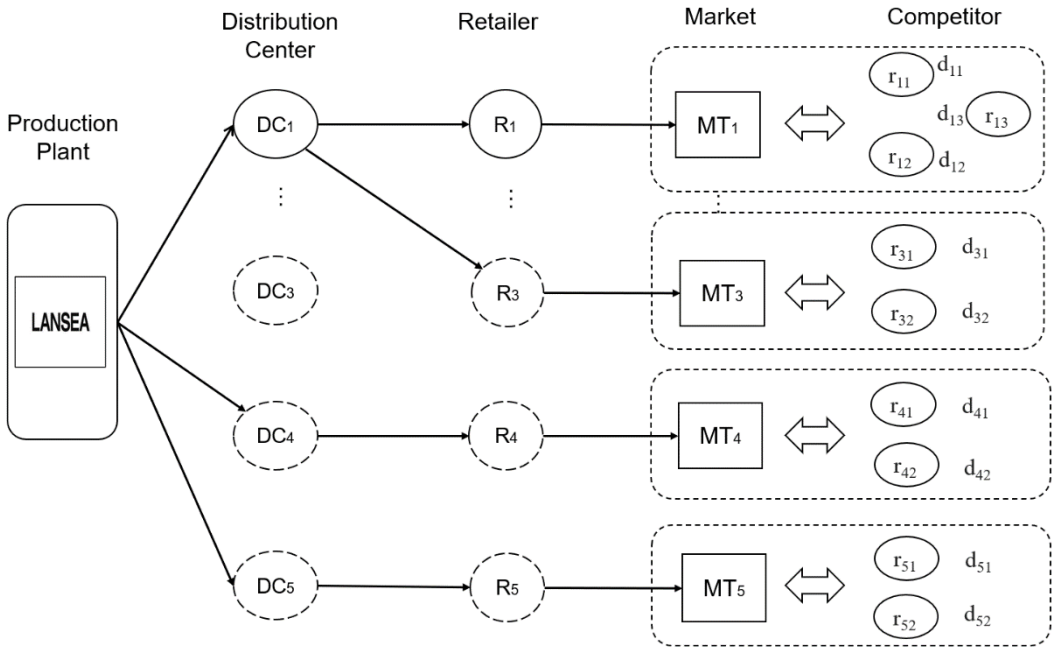


Figure 5-2 The optimization SCND under Oligopolistic Competition

The supply routes identified are as follows: for market MT_3, the manufacturer needs to transport the products from the production factory to the distribution center DC_1 in the local market, and then to the retailers in the target market to complete the product supply. For market MT_4 and MT_5, products will be directly transported by the factory to the local self-built distribution center, and then sent to the corresponding retailers in the market to complete the product supply. According to the calculation example, the specific solution results are shown as follows: In the local market MT_1, the equilibrium price $p_1^* = 7.64$. The corresponding profit $\Pi_1^* = 38.58$. Among the new market

entrants MT_3, MT_4 and MT_5, the corresponding equilibrium price (p_3^*, p_4^*, p_5^*) = (8.09, 6.87, 6.94). The corresponding final profit $(\Pi_3^*, \Pi_4^*, \Pi_5^*)$ = (8.06, 12.01, 10.62). The total profit of manufacturers in all markets is 69.27.

Chapter 6 Discussions

As an emerging medium and high-end hair dryer manufacturer in China, LANSEA needs to consider the competition with other manufacturers in order to occupy a certain market share in this market segment. At present, for the domestic high-end hair dryer market, the main products include Dyson, AIRFLY and REPRONIZER 4D Plus, etc. Compared with traditional hair dryers, these products meet higher functional requirements and can provide consumers with more comfortable experience, including but not limited to effective hair protection, intelligent temperature control and noise reduction. With the development of social and economic level, quite a few consumer groups put forward higher demand for small household appliances. LANSEA and other high-end hair dryer products can effectively realize the customer value under the trend of consumption upgrading. According to the actual background, LANSEA has established manufacturing plants and corresponding supply facilities in China, which can fully meet the needs of domestic consumers for medium and high-end products. After determining the supply link of the local market, the manufacturer LANSEA needs to consider the oligopolistic competition problem in the market segment. There are competitors including Dyson, AIRFLY and other early entrants. In the same market segment, the operation decision of the manufacturer will have an impact on the product demand of the competitor. Facing the consumer demand in the competitive market, the manufacturer LANSEA needs to complete relevant decisions at the operational level, including product pricing, supply service level, etc. This problem not only involves the product demand of each manufacturer, but also needs to consider the manufacturer's own unit product production cost, supply cost and product holding cost. By optimizing the decision of operational variables, the goal of profit maximization in the local market is realized. For other candidate markets, LANSEA needs to consider the design of supply chain network under oligopolistic competition. In addition to the local market, consumer groups in other countries or regions pay special attention to the intelligent

function and use experience of small household appliances due to the improvement of the overall income level. Facing the market demand under the trend of consumption upgrading, LANSEA can choose to become a new entrant in several subsequent markets to fully meet the product demand of potential consumers and increase the total profit of the manufacturer.

In this case, the manufacturer LANSEA needs to make two decisions regarding the optimal design of supply chain network: The first is to select a number of candidate markets and become new entrants in these overseas markets; The second is to determine whether to establish the appropriate distribution center in the new market. In any candidate market, there are several new entrants. LANSEA needs to consider oligopolistic competition in different markets. For specific candidate markets, manufacturers need to analyze the product demand of existing competitors, and combine with their own product supply conditions to determine the product pricing, market demand and corresponding profits and other factors under competitive circumstances. In addition, relevant constraints should be considered in the process of problem modeling. For example, the LANSEA production plant has a maximum capacity limit. Assuming that the plant is the only source of supply of hair dryer products, appropriate capacity allocation needs to be considered. Under the premise of meeting the demand of each new product entering the market, the manufacturer realizes the goal of maximizing profit. At the same time, the supply of products in overseas markets can be realized through the distribution center in the local market, but it also needs to meet the constraints of maximum distribution capacity.

According to the experiment of supply chain network design, the constraint of factory capacity directly affects the selection of new market entry and the final profit. From the oligopoly competition analysis of each candidate market, we can determine the product equilibrium demand and profit under different supply paths. Based on the constraints

of factory capacity and distribution capacity, the optimal design of supply network under specific conditions can be obtained. When the factory capacity is not fixed, different levels of factory capacity ceiling are given to explore the benefits of manufacturers under different conditions and the results of new market entry. The specific relationship diagram is as follows:

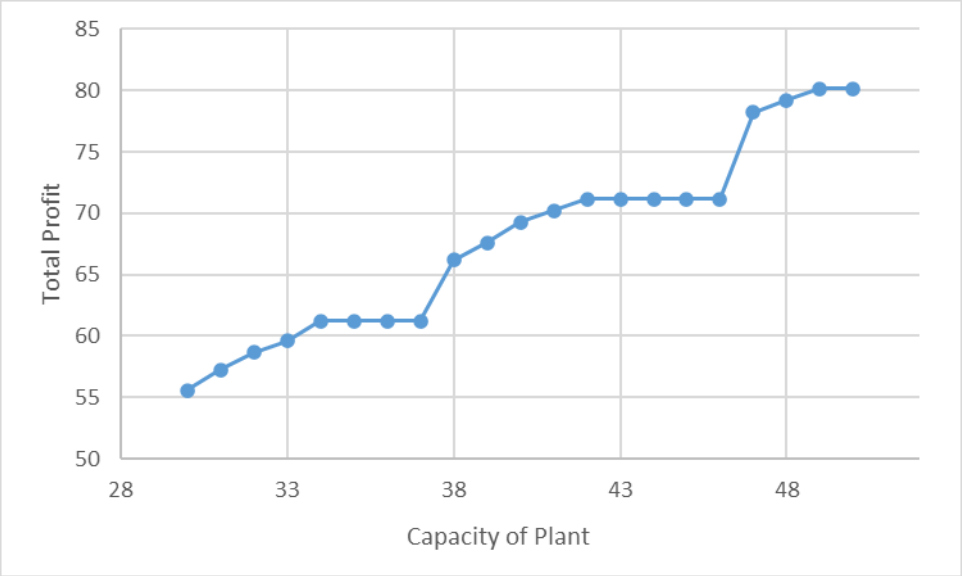


Figure 6-1 Total Profit of Manufacturers under Different Production Capacities

As can be seen from Figure 6-1, as a whole, the higher the production capacity ceiling of the factory, the larger the total profit of the corresponding manufacturer, but the growth of the two is not completely proportional. According to the change image, when the factory capacity is in the partial range, the overall profit of the manufacturer will not expand accordingly. Combined with the optimization design model of supply chain network, when the expanded capacity of the manufacturer is not enough to meet the demand of all the products entering the market, the original product supply network will not increase the supply link to the candidate market, so the manufacturer's product profit will not increase. According to the relationship between new market entry in Figure 5-2, when the manufacturer's production capacity increases to a certain critical value, the number of candidate markets that can be entered increases accordingly.

Through the decision of the supply path, the total profit of the manufacturer has been improved to a large extent. In practice, expanding the factory capacity ceiling will also increase the corresponding fixed and variable costs. If the product demand cannot be increased through the existing capacity, the actual profit of the manufacturer will be reduced. According to the supply chain network design experiment in this thesis, when the upper capacity of the manufacturer is increased to 42 units, the total profit will also rise to 71.14. This is also the optimal case in the range of adjacent values.

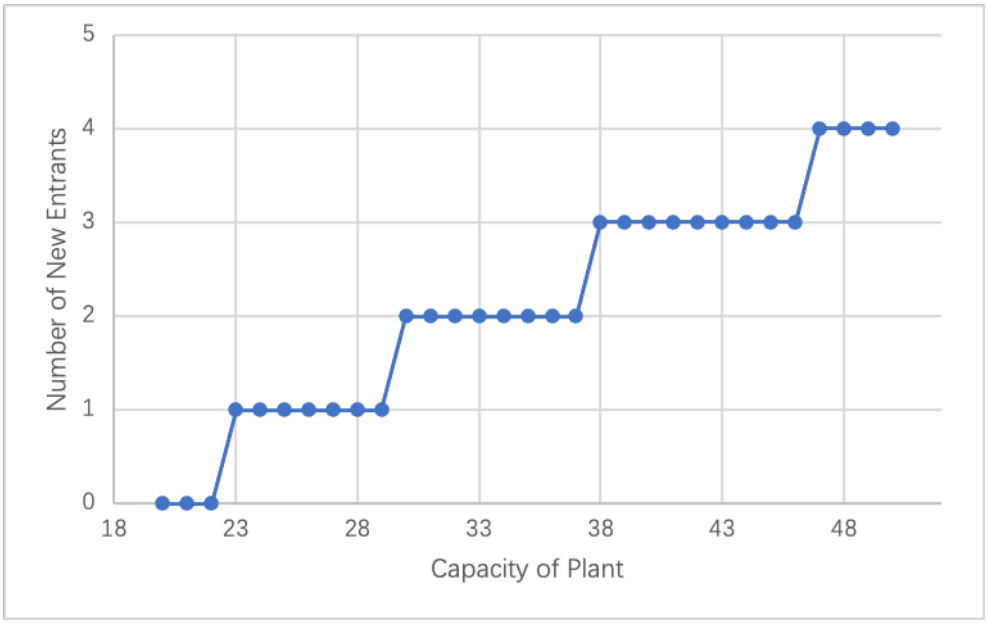


Figure 6-2 Number of New Entrants under Different Production Capacities

Based on the example of supply chain network design, the equilibrium demand and profit in different candidate markets will directly affect the optimal design of the final supply chain network. In addition, the selection of different distribution centers corresponds to different supply paths, and the supply of unit products in specific markets is also different. The demand function of the firm in the candidate market will affect the product pricing and service level under the competitive equilibrium. Changes in the demand function will also lead to changes in the final supply network design. In this problem, the candidate market MT_2 is selected as an example to explore the

influence of demand base a_2 on the optimal design of supply chain network. By changing the parameter setting of the manufacturer LANSEA in the corresponding market, the decision of new entry in the optimal situation is solved. Specific results are shown in the table below:

Table 6-1 Market Selection under Different Demand-base Conditions

需求基数 $a2$	MT_2	MT_3	MT_4	MT_5	总利润
15		√（DC_1）	√	√	69.27
16	√	√（DC_1）	√		70.20
17	√	√（DC_1）		√	70.54
18	√	√（DC_1）		√	72.39
19	√	√（DC_1）		√（DC_1）	72.63
20	√		√		69.76
21	√		√		71.95
22	√		√		74.26

As can be seen from the above table, there are great differences in supply chain network design under different demand base conditions. According to the solution results of this experiment, as the vendor's demand base in the candidate market increases, Manufacturers' demand for products in corresponding markets is also expanding. In the case that factory capacity remains the same, the choice of candidate markets will also change. When the demand base is in the range of 16 to 22, vendors always consider MT_2 as a new entrant to the market. According to the capacity surplus and market demand conditions, select the appropriate and optimal candidate market from MT_3, MT_4 and MT_5. As the demand base of MT_2 increases, the total profit basically increases. However, when the base increases to 20, the number of new markets is reduced to two, and the total profit decreases accordingly, because the factory's remaining capacity cannot meet the product demand of the third market. From the above analysis, it can be seen that the demand base of the manufacturer in the candidate market will have an impact on the final supply network design and profit. Maintaining high product

competitiveness to attract a certain number of customer groups, to improve the overall profit is of great significance.

Based on the analysis of model simulation, we can find that many key factors affect the supply chain design significantly, including the competition, manufacturing and logistics. Firstly, the competition in different markets influence the equilibrium price and service level and the supply chain optimization design. Also, the manufacturing represents the production ability. If the factory has a larger production capability, the total profit will be in an increasing trend. Lastly, logistics decides the supply path of different candidate markets. It will affect the supply cost of products and the final total profit.

With the gradual acceleration of economic globalization and scientific and technological development, consumers' purchasing behaviors of products are constantly changing, and the nature of industrial competition is also undergoing fundamental changes (Rezapour et al., 2014). In the past, the competition mode mainly considered the product competition between different companies, but now it is transformed into the market competition between different supply chains. In the theoretical framework of this thesis, there are mainly three key parts, including consumer value creation, product positioning and supply chain strategy. With the development of consumer needs or value, our enterprise should anchor in new positioning product and struggle to solve the blockade problem on the core technologies. After targeting a new product, we consider the supply chain strategy and the specific structure. This is an entire process of producing a valuable product which is fully satisfying the consumer needs. However, in the practice of enterprise work, these three parts are connected and form a closed loop. It means that with the development of products and consumer needs, the product must update and iterate constantly. Thus, the

above steps form a circular process and product development is also an evolutionary spiral.

Chapter 7 Conclusion

At present, with the continuous improvement of social economy and people's living standards, the product demand of many consumers has undergone great changes. Instead of pursuing the quantity or quality of products in the past, the current customer group pays more attention to the function and use experience of products. Faced with the potential product demand of a certain category of high-end consumer goods, different enterprises will choose to become new entrants in this market segment and occupy a position. In order to achieve the goal of profit, enterprises should not only consider the product competition in the same market segment, but also complete the optimization design of supply chain network in different regional markets, so as to obtain the maximum economic benefits.

Firstly, this thesis proposes a research framework from developing new products to designing the supply chain. The theoretical framework mainly covers three parts, including consumer value creation, product repositioning and supply chain strategy. Enterprises take consumer value as a starting point to identify the change of customer needs and then complete market segmentation based on it. Combined with their own actual situation, enterprises need to determine the target product and company strategy. Finally, based on the first two parts, enterprises should identify the supply chain strategy and the whole structure, to achieve cost reduction and efficiency increase. As shown in the theoretical framework, each link is interrelated and influences each other to form an organic whole. The theoretical analysis of consumer value creation, product repositioning and supply chain strategy is of great significance for companies to explore how to develop new products and achieve profit maximization.

Secondly, this thesis reviews the key factors in constructing the supply chain, including competiton, geo-politics, manufacturing and logistics. The corporations in the actual

markets have to consider the influence of competitors on product demand, so as to realize the optimal design of supply chain network under oligopoly competition. Geo-politics is a crucial factor which influences various processes in the supply chain network. Geopolitical crisis will lead to trade protectionism, irrational technological blockade and economic sanctions sometimes so as to change the whole design of constructing supply chain. Morever, the production ability affects the result of satisfying supply needs. New Technology brings changes in the manufacturing and reconstruction of the facilities. Logistics is an important link between production and product delivery, which is a core issue in enterprise management. It is also a key factor in the construction of supply chain related with consuming time and logistics efficiency improvement.

Thirdly, this thesis explores the supply chain design strategy under the oligarchic competition. We study the supply chain construction for LANSEA, an emerging domestic hair dryer manufacturer, as an exemplar case to study supply chain construction for a new product manufacturer. LANSEA was founded in 2016 in China. With high-speed frequency conversion motor and bladeless technology as its core competitiveness, LANSEA is positioned in the Medium-high end functional hair dryer, aiming to occupy a certain share of various market segments. This part mainly introduces the background of optimization design of supply chain network under oligopoly competition and constructs a two-layer supply chain network model combined with practical problems. The external model considers the competitive game in any candidate market. Internally, the problem considers a supply chain network that includes manufacturing plants, distribution centers and retailers.

Lastly, this thesis builds a new product supply chain through the math model and stimulation under the oligarchic competition. Based on the above analysis, this thesis obtains the influencing variables such as unit product cost, holding cost and

corresponding market sales in the supply link. The final decision of supply chain network design is determined based on the constraints of factory capacity and distribution capacity. For the network design problem, the model decisions of the two parts are mutually influenced. Therefore, manufacturers need to consider the actual competition situation of each market, complete the supply chain network design from a global perspective, and determine the optimal solution of the whole problem. In conclusion, with the development of consumer needs, the enterprise should anchor in new positioning product and try to overcome the blockade on the core technologies. After targeting a new product, our enterprise should consider the supply chain strategy and the specific structure. This is an entire process of producing a valuable product which is fully satisfying the consumer needs. However, in the practice of enterprise work, these three parts are connected and form a closed loop. It means that with the development of products and consumer needs, the product must update and iterate constantly. Thus, the above steps form a circular process and product development is also an evolutionary spiral.

In the future, we can further explore the optimization problem of complex supply chain network which includes various suppliers and the risk of supply interruption. Also, the price and service proposed by the stimulation need to be verified in the actual business operation. In addition, the model should be reconstructed so as to optimize and iterate the math model for the spiral improvements.

References

Aboolian, R., Berman, O., & Wang, J. (2021). Responsive make-to-order supply chain network design. *Naval Research Logistics (NRL)*, *68*(2), 241-258.

Almquist, E., Senior, J., & Bloch, N. (2016). The elements of value. *Harvard business review*, *94*(9), 47-53.

Baghalian, A., Rezapour, S., & Farahani, R. Z. (2013). Robust supply chain network design with service level against disruptions and demand uncertainties: A real-life case. *European journal of operational research*, *227*(1), 199-215.

Bashiri, M., & Tabrizi, M. M. (2010). Supply chain design: A holistic approach. *Expert Systems with Applications*, *37*(1), 688-693.

Baud-Lavigne, B., Agard, B., & Penz, B. (2012). Mutual impacts of product standardization and supply chain design. *International Journal of Production Economics*, *135*(1), 50-60.

Bernstein, F., & Federgruen, A. (2004). A general equilibrium model for industries with price and service competition. *Operations research*, *52*(6), 868-886.

Calleja, G., Corominas, A., Martínez-Costa, C., & de la Torre, R. (2018). Methodological approaches to supply chain design. *International Journal of Production Research*, *56*(13), 4467-4489.

Cardona-Valdés, Y., Álvarez, A., & Ozdemir, D. (2011). A bi-objective supply chain design problem with uncertainty. *Transportation Research Part C: Emerging Technologies*, *19*(5), 821-832.

Christopher, M., Peck, H., & Towill, D. (2006). A taxonomy for selecting global supply chain strategies. *The International Journal of Logistics Management*.

Corominas, A., Mateo, M., Ribas, I., & Rubio, S. (2015). Methodological elements of supply chain design. *International Journal of Production Research*, *53*(16), 5017-5030.

Day, G. S. (1999). *Market driven strategy: process for creating value: with a new information*. Free.

Fallah, H., Eskandari, H., & Pishvaee, M. S. (2015). Competitive closed-loop supply chain network design under uncertainty. *Journal of Manufacturing Systems*, *37*, 649-661.

Farahani, R. Z., Rezapour, S., Drezner, T., & Fallah, S. (2014). Competitive supply chain network design: An overview of classifications, models, solution techniques and applications. *Omega*, *45*, 92-118.

Fattahi, M., Govindan, K., & Keyvanshokooh, E. (2017). Responsive and resilient supply chain network design under operational and disruption risks with

delivery lead-time sensitive customers. *Transportation research part E: Logistics and transportation review*, *101*, 176-200.

Freytag, P. V., & Clarke, A. H. (2001). Business to business market segmentation. *Industrial marketing management*, *30*(6), 473-486.

Gan, T. S., & Grunow, M. (2013). Concurrent product–supply chain design: a conceptual framework & literature review. *Procedia CIRP*, *7*, 91-96.

Godsell, J., Diefenbach, T., Clemmow, C., Towill, D., & Christopher, M. (2011). Enabling supply chain segmentation through demand profiling. *International Journal of Physical Distribution & Logistics Management*.

Goh, M., Lim, J. Y., & Meng, F. (2007). A stochastic model for risk management in global supply chain networks. *European Journal of Operational Research*, *182*(1), 164-173.

Grönroos, C. (2011). A service perspective on business relationships: The value creation, interaction, and marketing interface. *Industrial marketing management*, *40*(2), 240-247.

Guillén, G., Mele, F. D., Bagajewicz, M. J., Espuna, A., & Puigjaner, L. (2005). Multiobjective supply chain design under uncertainty. *Chemical Engineering Science*, *60*(6), 1535-1553.

Hassan, S. S., & Craft, S. H. (2005). Linking global market segmentation decisions with strategic positioning options. *Journal of Consumer Marketing*.

Holbrook, M. B. (1999). Consumer value. *A Framework for Analysis and Research; Routledge: London, UK*.

Horvath, L. (2001). Collaboration: the key to value creation in supply chain management. *Supply chain management: an international journal*.

Huang, E., & Goetschalckx, M. (2014). Strategic robust supply chain design based on the Pareto-optimal tradeoff between efficiency and risk. *European Journal of Operational Research*, *237*(2), 508-518.

Javid, A. A., & Azad, N. (2010). Incorporating location, routing and inventory decisions in supply chain network design. *Transportation Research Part E: Logistics and Transportation Review*, *46*(5), 582-597.

Jüttner, U., Christopher, M., & Godsell, J. (2010). A strategic framework for integrating marketing and supply chain strategies. *The International Journal of Logistics Management*.

Kaul, A., & Rao, V. R. (1995). Research for product positioning and design decisions: An integrative review. *International Journal of research in Marketing*, *12*(4), 293-320.

Kotler, P. (2003). *Marketing insights from A to Z: 80 concepts every manager needs to know*. John Wiley & Sons.

Meixell, M. J., & Gargeya, V. B. (2005). Global supply chain design: A literature review and critique. *Transportation Research Part E: Logistics and Transportation Review*, *41*(6), 531-550.

Pashaei, S., & Olhager, J. (2015). Product architecture and supply chain design: a systematic review and research agenda. *Supply Chain Management: An International Journal*.

Petersen, K. J., Handfield, R. B., & Ragatz, G. L. (2005). Supplier integration into new product development: coordinating product, process and supply chain design. *Journal of operations management*, *23*(3-4), 371-388.

Rezapour, S., & Farahani, R. Z. (2014). Supply chain network design under oligopolistic price and service level competition with foresight. *Computers & Industrial Engineering*, *72*, 129-142.

Rezapour, S., Farahani, R. Z., Dullaert, W., & De Borger, B. (2014). Designing a new supply chain for competition against an existing supply chain. Transportation research part E: Logistics and transportation review, 67, 124-140.

Rezapour, S., Farahani, R. Z., & Pourakbar, M. (2017). Resilient supply chain network design under competition: a case study. *European Journal of Operational Research*, *259*(3), 1017-1035.

Ries, A., & Trout, J. (2001). *Positioning: The battle for your mind*. McGraw Hill.

Sabri, E. H., & Beamon, B. M. (2000). A multi-objective approach to simultaneous strategic and operational planning in supply chain design. *Omega*, *28*(5), 581-598.

Sadghiani, N. S., Torabi, S. A., & Sahebjamnia, N. (2015). Retail supply chain network design under operational and disruption risks. *Transportation Research Part E: Logistics and Transportation Review*, *75*, 95-114.

Sadjady, H., & Davoudpour, H. (2012). Two-echelon, multi-commodity supply chain network design with mode selection, lead-times and inventory costs. *Computers & Operations Research*, *39*(7), 1345-1354.

Santoso, T., Ahmed, S., Goetschalckx, M., & Shapiro, A. (2005). A stochastic programming approach for supply chain network design under uncertainty. *European Journal of Operational Research*, *167*(1), 96-115.

Shanker, A. (2012). A customer value creation framework for businesses that generate revenue with open source software. *Technology Innovation Management Review*, *2*(3).

Sharifi, H., Ismail, H. S., & Reid, I. (2006). Achieving agility in supply chain through simultaneous “design of” and “design for” supply chain. *Journal of Manufacturing Technology Management*.

Shen, Z. J. M., & Qi, L. (2007). Incorporating inventory and routing costs in strategic location models. *European journal of operational research*, *179*(2), 372-389.

Sheth, J. N., Newman, B. I., & Gross, B. L. (1991). Why we buy what we buy: A theory of consumption values. *Journal of business research*, *22*(2), 159-170.

Simchi-Levi, D., Kaminsky, P., Simchi-Levi, E., & Shankar, R. (2008). *Designing and managing the supply chain: concepts, strategies and case studies*. Tata McGraw-Hill Education.

Slater, S. F. (1997). Developing a customer value-based theory of the firm. *Journal of the Academy of marketing Science*, *25*(2), 162-167.

Smith, J. B., & Colgate, M. (2007). Customer value creation: a practical framework. *Journal of marketing Theory and Practice*, *15*(1), 7-23.

Snyder, L. V., Scaparra, M. P., Daskin, M. S., & Church, R. L. (2006). Planning for disruptions in supply chain networks. In *Models, methods, and applications for innovative decision making* (pp. 234-257). Informs.

Sweeney, J. C., & Soutar, G. N. (2001). Consumer perceived value: The development of a multiple item scale. *Journal of retailing*, *77*(2), 203-220.

Vargo, S. L. (2008). Customer integration and value creation: paradigmatic traps and perspectives. *Journal of service research*, *11*(2), 211-215.

Verhoef, P. C., & Lemon, K. N. (2013). Successful customer value management: Key lessons and emerging trends. *European Management Journal*, *31*(1), 1-15.

Wang, G., Huang, S. H., & Dismukes, J. P. (2005). Manufacturing supply chain design and evaluation. *The International Journal of Advanced Manufacturing Technology*, *25*(1), 93-100.

Weimin, M., Bin, L., Bo, X., & Fayou Z. (2015). Reliable supply chain network design under facility disruption and demand uncertainty. *Systems Engineering-Theory & Practice, 35*(08), 2025-2033.

Yuxiang, Y., Gengui, Z. (2011). Study on location model of facility competition for closed loop supply chain network. *Chinese Journal of Management Science, 19*(05), 50-57.

Zimmerman, A., & Blythe, J. (2017). *Business to business marketing management: A global perspective*. Routledge.