



**The Construction and Application of Brand Value  
Evaluation Model for China's Pharmaceutical Industry**

**Li Dacan**

Thesis submitted as partial requirement for the conferral of the degree of

**Doctor of Management**

Supervisor:

Prof. Hélia Gonçalves Pereira, Assistant Professor,

ISCTE University Institute of Lisbon

June, 2019



Instituto Universitário de Lisboa

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## Declaration

I declare that this thesis does not incorporate without acknowledgment any material previously submitted for a degree or diploma in any university and that to the best of my knowledge it does not contain any material previously published or written by another person except where due reference is made in the text.

Signed: *Li Dacan*

Date: 06.06.2019

Name: Li Dacan

## 作者申明

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## Abstract

In today's information age, strong brands can prolong the life cycle of products and enhance the competitiveness and overall value of pharmaceutical enterprises. Therefore, this study hopes to build a set of brand value evaluation system suitable for Chinese pharmaceutical industry, and dig deep into the connotation of brand value of Chinese pharmaceutical industry.

Through a brief analysis of the advantages and limitations of the current mainstream brand value assessment methods at home and abroad, this study selects the relatively authoritative Interbrand model to optimize and improve. The improvement of Interbrand model mainly involves the following three aspects: First, for the determination of the brand function index, the analytic hierarchy process is used instead of the expert scoring method to determine the excess return that the brand brings to the enterprise. The second is to introduce consumer strength and socio-cultural strength when calculating brand strength. Thirdly, the weight of each factor of brand strength is adjusted, and the fuzzy comprehensive evaluation method is used to calculate the evaluation index. Finally, Y Company is taken as an example to apply the adjusted Interbrand model, and the rationality of the results of this study is expounded.

This study modifies the Interbrand model as the basic model, and preliminarily constructs the brand value evaluation system of Chinese pharmaceutical industry, hoping to enrich the research of brand value of Chinese pharmaceutical enterprises with a certain reference significance.

**Keywords:** Pharmaceutical industry; Brand value evaluation; Interbrand; Fuzzy comprehensive evaluation method

**JEL:** I11; M31

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## Resumo

Atualmente, na era da informação, marcas fortes podem prolongar o ciclo de vida dos seus produtos e melhorar a competitividade e valor global das empresas na indústria farmacêutica. Neste sentido, este estudo espera contribuir para a construção de um sistema de avaliação de valor da marca ajustado à indústria farmacêutica na China, procurando aprofundar, igualmente, a noção de valor de marca para esta indústria.

Através de uma análise das vantagens e desvantagens dos principais métodos de avaliação de marca, nacional e internacionalmente, este estudo selecionou o modelo Interbrand para o otimizar e melhorar neste contexto.

A tentativa de melhoria do Modelo Interbrand envolve 3 aspetos: primeiro, para a determinação do índice de função de marca, o processo de hierarquia analítica é usado em vez do método de pontuação de especialistas para determinar o retorno que a marca traz à empresa. O segundo procura apresentar a força do consumidor e a força sociocultural ao calcular a força da marca. Finalmente, o peso de cada fator de força da marca é ajustado, e o método de avaliação abrangente *fuzzy* é usado para calcular o índice de avaliação. Finalmente, o Grupo Y é usado como exemplo para aplicar o Modelo Interbrand ajustado, e a racionalidade dos resultados deste estudo é apresentada

Este estudo modifica o modelo Interbrand como modelo básico e procura atualizá-lo para construir um sistema de avaliação do valor da marca para a indústria farmacêutica na China esperando enriquecer a investigação nesta área.

**Palavras-chave:** Indústria Farmacêutica; Avaliação do valor da marca; Interbrand; Método de Avaliação Fuzzy

**JEL:** I11; M31

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## 摘要

在当今信息化时代，强有力的品牌能延长产品的生命周期，提升医药企业的竞争力和整体价值。因此，本文希望构建一套适合中国医药行业的品牌价值评估体系，深层次挖掘中国医药行业品牌价值内涵。

本文通过对目前国内外主流的品牌价值评估方法的优点和局限性作简要分析，选取相对有权威性的 Interbrand 模型进行优化改进，主要涉及以下三方面：一是对于品牌作用指数的确定，运用层次分析法代替专家打分法，确定品牌给企业带来的超额收益。二是在品牌强度计算时引入消费者强度和社会文化强度，构建更综合、全面的品牌强度体系。三是对品牌强度各因素的权重进行了调整，计算时采用模糊综合评价法，获得更加客观的评估结论。最后以中国 Y 公司为例对调整的 Interbrand 模型进行应用，并阐述本文计算结果的合理性。

本文对 Interbrand 模型作为基础模型进行修正，初步构建了中国医药行业品牌价值评估体系，希望对丰富中国医药企业品牌价值研究具有一定参考意义。

**关键词：** 医药行业；品牌价值评估；Interbrand；模糊综合评价法

**JEL:** I11; M31

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# Contents

Chapter 1: Introduction.....	1
1.1 The brand status of pharmaceutical industry in China.....	1
1.2 Research significance.....	3
1.2.1 Theoretical significance.....	3
1.2.2 Practical significance.....	4
1.3 Research problem.....	6
1.4 Research purpose.....	8
1.5 Research contents and framework.....	8
1.6 Brief summary.....	10
Chapter 2: Research Background.....	12
2.1 Overview of pharmaceutical industry in China.....	12
2.1.1 Definition of pharmaceutical companies.....	12
2.1.2 Characteristics of pharmaceutical companies.....	12
2.1.3 Type of pharmaceutical company.....	14
2.1.4 Classification of pharmaceutical products.....	15
2.2 The market environment analysis of Chinese pharmaceutical industry.....	15
2.2.1 Political environment.....	16
2.2.2 Economic environment.....	20
2.2.3 Social environment.....	21
2.2.4 Technology environment.....	23
2.3 The status quo of the pharmaceutical industry.....	24
2.3.1 The status quo of global pharmaceutical industry.....	24
2.3.2 The status quo of Chinese pharmaceutical industry.....	28
2.3.3 Comparative analysis of the status quo of global and Chinese pharmaceutical enterprises .....	31
2.4 The necessity of implementing brand strategy in Chinese pharmaceutical industry..	33
2.5 Ways to shape the brand of Chinese pharmaceutical enterprises.....	34
2.6 Research questions.....	36
2.7 Brief summary.....	37
Chapter 3: Literature Review.....	38

3.1 Theories of brand.....	38
3.1.1 Definition of brand.....	38
3.1.2 Classification of brands.....	41
3.1.3 Characteristics of brand.....	42
3.1.4 Brand management.....	43
3.2 Theories of brand value.....	43
3.2.1 Connotation of brand value.....	43
3.2.2 Formation mechanism of brand value.....	45
3.2.3 The characteristics of brand value.....	46
3.3 Brand value evaluation methods.....	47
3.3.1 Financial-factors-based assessment methods.....	47
3.3.2 Market-factors-based assessment methods.....	50
3.3.3 Consumer-factors-based assessment methods.....	58
3.3.4 Contrasts of assessment methods of different perspectives.....	62
3.4 Brief summary.....	63
Chapter 4: Conceptual Model - Improvement based on Interbrand Model.....	64
4.1 Principles for constructing evaluation system of brand value.....	64
4.2 Reasons for constructing the evaluation model from the perspective of consumers..	65
4.3 The applicability analysis of interbrand model from the perspective of consumers..	66
4.3.1 Advantages of interbrand model.....	67
4.3.2 Disadvantages of interbrand model.....	68
4.4 Planned improvement contents based on interbrand model.....	69
4.5 Brief summary.....	70
Chapter 5: Methodology.....	72
5.1 Research method.....	72
5.1.1 Questionnaire method.....	72
5.1.2 Expert consultation method.....	72
5.1.3 Analytic hierarchy process.....	72
5.1.4 Fuzzy comprehensive evaluation method.....	73
5.2 Improvement in brand earnings.....	73
5.2.1 Improvement in earnings of intangible assets.....	73
5.2.2 Determining the brand function index.....	74
5.3 Improvement of brand strength.....	77
5.3.1 Questionnaire survey.....	78
5.3.2 Delphi expert interview method.....	80

5.3.3 Improvement of brand strength factors.....	83
5.3.4 Application of fuzzy comprehensive evaluation method.....	90
5.4 Brief summary.....	91
Chapter 6: Case Application.....	92
6.1 Research subjects.....	92
6.1.1 Introduction to Y Company.....	92
6.1.2 Analysis of brand positioning of Y Company.....	95
6.1.3 Data sources.....	96
6.2 Evaluation elements.....	97
6.2.1 Purposes of evaluation.....	97
6.2.2 Evaluation hypothesis.....	97
6.2.3 Base date of assets evaluation.....	98
6.3 Evaluation process of the brand value of Y Company.....	99
6.3.1 Determination of earnings of intangible assets of Y Company.....	99
6.3.2 Determination of indicators of the brand effect of Y Company.....	99
6.3.3 Determination of earnings of the brand of Y Company.....	104
6.3.4 Determination of the brand strength of Y Company.....	105
6.3.5 Calculation of the brand value of Y Company.....	113
6.4 Brief summary.....	114
Chapter 7: Analysis of Evaluation Results.....	115
7.1 Analysis of rationality of evaluation results.....	115
7.2 Analysis of difference of evaluation results.....	115
7.3 Extended analysis of evaluation results.....	117
7.4 Brief summary.....	118
Chapter 8: Research Conclusions and Prospects.....	119
8.1 Research conclusions.....	119
8.2 Suggestions for increasing the brand value of China's pharmaceutical industry.....	120
8.3 Future research prospects.....	122
Bibliography.....	125
Webliography.....	131
Other References.....	133
Appendix 1: Related Figures.....	135
Appendix 2: Related Tables.....	145
Appendix 3: Questionnaire.....	157

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## List of Tables

Table 3-1 Composition and weight of brand strength factor in interbrand brand valuation model.....	52
Table 3-2 Financial world model calculation procedures.....	54
Table 3-3 Brand equity ten model of David Aaker.....	59
Table 5-1 Definition of dimensions of analytic hierarchy process.....	76
Table 5-2 Statistics overview of the questionnaire results.....	79
Table 5-3 Expert background.....	81
Table 5-4 Experts' first-round scoring through the delphi method.....	82
Table 5-5 Brand strength indicators in China's pharmaceutical industry 84Table 6-1 Earnings of intangible assets of Y Company (2015-2017) (Unit: yuan/RMB).....	99
Table 6-2 Weights of the criterion layer.....	101
Table 6-3 Weights of quality advantages.....	102
Table 6-4 Weights of price advantages.....	103
Table 6-5 Weights of competition advantages.....	104
Table 6-6 Weights of factors of intangible assets of Y Company.....	105
Table 6-7 Earnings of the brand of Y Company(2015-2017) (Unit: yuan/RMB).....	105
Table 6-8 Weights of the criterion layer.....	107
Table 6-9 Weights of all factors of the brand strength of Y Company.....	110
Table 6-10 Evaluation indicator system of the brand strength of the Y Company.....	112
Table 7-1 Comparison of brand value evaluation of Y Company in 2018 evaluated by evaluation agencies from China and other countries.....	115
Table 7-2 Comparison of brand value evaluation of Y Company in 2018 analyzed by evaluation agencies from China and other countries.....	116

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## List of Figures

Figure 1-1 The study framework.....	9
Figure 2-1 The market environment of China's pharmaceutical enterprises.....	16
Figure 2-2 Per capita disposable income and consumption expenditure of China's residents.	21
Figure 2-3 Proportion of R&D investment of per country to total R&D investment of top50 global pharmaceutical enterprises in 2017.....	26
Figure 3-1 Interbrand valuation model.....	51
Figure 3-2 Brand strength s-curve.....	53
Figure 5-1 Structure of analytic hierarchy process.....	75
Figure 5-2 Delphi method process.....	81
Figure 6-1 AHP model of earnings of intangible assets of the brand.....	100
Figure 6-2 Model of the brand strength of the pharmaceutical industry.....	106

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## Chapter 1: Introduction

### 1.1 The brand status of pharmaceutical industry in China

Brand strategy is a national strategy. On the eve of International Labor Day in 2017, the State Council of China approved the establishment of “China Brand Day”. All industries throughout the China are exploring the way to realize the upgrading of supply and demand structure by taking brand as the guide. An unprecedented brand movement is sweeping across China. David and Robert (2001) contends that an increasing number of high-technology companies have undertaken brand-building initiatives under the premise that these initiatives can create an asset that generates long-term profits. The pharmaceutical industry is no exception. The State Council of the People's Republic of China (2016) promulgated *the Opinions on Promoting the Upgrading of the Supply and Demand Structure by Giving Full Play to the Leading Role of Brand*, especially emphasizing the importance of establishing the pharmaceutical brand strategy. Recognizing the importance of brand and strengthening the brand building are the problems that China's pharmaceutical enterprises should pay attention to in the market competition, and the long-term goal of the China's pharmaceutical enterprises is to shape the brands with national and even international competitiveness.

The pharmaceutical industry is one of the pillar industries in China, which is closely related to People's daily lives. The pharmaceutical industry is a high-tech intensive industry, together with information industry, which is known as the two fastest-growing industries in the world today. Wu (2003) considers that the pharmaceutical industry is regarded as the sunrise industry by the international community because of its huge development space and broad prospects, high-tech added value and high capital profit margin. After decades of development, China's pharmaceutical enterprises have developed relatively mature, which is one of the fastest growing industries in China at this stage. According to the data of the National Bureau of Statistics of China, by the end of 2016, there had been 7940 pharmaceutical manufacturing enterprises in China, more than 11,000 pharmaceutical wholesale enterprises and more than 200,000 pharmaceutical retail enterprises. The number of employees in the pharmaceutical industry had exceeded 5 million, and the annual output value of the pharmaceutical industry had exceeded 3 trillion yuan.

With the continuous advancement of medical reform, the Chinese pharmaceutical industry is also facing increasingly fierce market competition. In particular, the entry of more and more foreign pharmaceutical companies has formed a huge impact on the Chinese pharmaceutical industry. Zheng (2012) contended that the competition between enterprises was no longer limited to products, but focused on higher-level brands. As the core competitiveness of pharmaceutical companies, a strong brand can extend the product life cycle. Successful brand management can strengthen consumers' awareness of the pharmaceuticals and they are willing to buy brands they recognize, thereby enabling brand owners to gain competitive advantages and maximizes the benefits. He (2016) proposed that those who owned and mastered the high-quality “pharmaceutical brand” would be able to finish the company sales objectives, gain a leading edge in the fierce drug market competition, and win the favor of consumers and the market. So both Chinese and international pharmaceutical companies have considered establishing and improving pharmaceutical brands and strengthening and promoting brand management as an important task for the survival and development of enterprises. However, there are still some problems in brand management of Chinese pharmaceutical industry:

Many pharmaceutical enterprises in China have a vague understanding of the brand cognition, considering that building the brand is a matter of the future and the current key task is to survive; Many pharmaceutical enterprises pay attention to brands but ignore product quality, or overlook quality management because of one-sided pursuit of output, eventually devaluing the intangible assets of the enterprises; There is also a lack of planning for the construction of business concepts and values in some enterprises. They often use short-term price promotions to solve market problems, exchange the immediate interests at the expense of the long-term interests of enterprises, and constantly destroy the established foundation of pharmaceutical brands. It engulfs the basic integrity spirit of pharmaceutical enterprises and leads to the inability to establish a pharmaceutical brand culture.

Zhang and Yan (2004) held the view that pharmaceutical enterprises, as an important force in the pharmaceutical industry, are knowledge-intensive industries with the characteristics of high-tech enterprises. They differ greatly from traditional industries in terms of production and operation modes, as well as in terms of value composition. Yan (2004) contends that specifically, the enterprise value of pharmaceutical enterprises is determined not only by the traditional financial indicators such as profitability, operating ability, long-term and short-term solvency and development ability, but also by non-financial factors such as

technological R&D ability, human capital situation and corporate governance.

However, at present, the brand value evaluation of China's pharmaceutical enterprises is often directly considered from the financial aspect, or non-financial factors are not reflected enough. In order to change this situation, China's pharmaceutical enterprises should implement the brand value evaluation strategy. That is, the enterprise should optimize the enterprise brand management according to the brand value evaluation system, establish a scientific brand management concept, improve the enterprise's R&D strength and product quality, and comprehensively enhance the enterprise brand competitiveness.

How to construct an effective brand value evaluation system to carry out pharmaceutical brand design that meets consumer and market needs has become an important issue of brand management for pharmaceutical companies in China. Implementing brand strategy and strengthening brand awareness will not only help the pharmaceutical industry to improve service levels and innovation capabilities, but also scientifically evaluate the value of pharmaceutical brands to truly reflect the value of pharmaceutical company assets, ensure the preservation and appreciation of corporate assets, and improve the operational benefits and optimal allocation of assets. Therefore, it is necessary to build a set of brand value evaluation model and index system suitable for China's pharmaceutical enterprises in this study.

## **1.2 Research significance**

With the advent of the knowledge economy, the competition among enterprises is no longer product-level competition, but the brand-competition at the higher level. Brand has become one of the most valuable enterprise assets to help enterprises resist the risks. David (2003) believes that brands is major drivers of enterprise value in the 21st century.

By studying the construction of brand value evaluation model for China's pharmaceutical enterprises, this study has important theoretical significance to enrich the composition of brand assets for China's pharmaceutical enterprises, and also has important practical significance to develop the brand of China's pharmaceutical enterprises.

### **1.2.1 Theoretical significance**

As an important part of intangible assets, the research of brand equity value evaluation enriches and perfects the theory of intangible assets value evaluation theory. This study analyzes the composition and index factors of brand value in China's pharmaceutical

enterprises, and then puts forward the brand value evaluation model suitable for China's pharmaceutical enterprises, which is of great significance to enrich the theory of brand equity of China's pharmaceutical enterprises.

At present, the international famous brand value evaluation methods have developed to a higher level. For China, there are two well-known brand evaluation methods, one is the ranking of China brand value published annually by Beijing Brand Asset Appraisal Co., Ltd., and the other is the loyalty factor method proposed by Fan Xiucheng, professor of international business school of Nankai University in 2000. However, I think these two methods do not combine the market and the financial situation of the enterprise well. Therefore, based on the adoption of the authoritative international Interbrand method, this study attempts to establish a brand value evaluation system that conforms to the characteristics of China's pharmaceutical enterprises and industries, hoping to provide some inspiration for the brand management and brand value promotion in the future.

### **1.2.2 Practical significance**

Brands can provide consumers with functional and additional benefits they believe are worth buying and imply a guarantee of product quality identity. Due to the intensified market competition, consumers can purchase according to their judgment of product information and personal preferences, and brand is undoubtedly an important carrier for achieving their satisfaction. Li (2009) proposes that with the introduction of a series of laws and regulations on registration, packaging, advertising, and prescription, the brand building of pharmaceutical companies is becoming more and more important, and the planning and management of brand has become the key to their success. As for the consumption concept of drugs, apart from the factor of price, consumers have also gradually increased their understanding of the intangible values behind drugs, including the brand satisfaction, design image and the social reputation, scientific and technological level, and cultural connotation of manufacturing companies. As an intangible asset, the brand value has become an important indicator to measure the comprehensive strength of pharmaceutical enterprises. This study mainly focuses on brand research of China's pharmaceutical enterprises, and its practical significance can be summarized as the following:

(1) It will objectively try to quantify the brand value of China's pharmaceutical enterprises and provide scientific basis for China's pharmaceutical enterprises to locate brands, plan brands and manage brands. Carol and Mary (1993) held the view that brand equity, was

the appropriate metric for evaluating the long-run impact of marketing decisions. Through the analysis of influencing factors of brand value in China's pharmaceutical enterprises, this study aims to make the enterprises understand the actual situation of their own brands, find out the advantages and disadvantages of brand management in comparison with their peers, realize the existence and profitability of brand equity value, and thus spur the brand management activities of enterprises.

(2) It will try to support pharmaceutical enterprises to integrate resources rationally, pay attention to capital operation, reveal the connotation of brand value, and lays a good foundation for pharmaceutical enterprises to realize the management of intangible assets with brand as the core. Through the evaluation of brand value, we can effectively excavate the connotation of brand value of China's pharmaceutical enterprises, give full play to the role of brand value in performance evaluation, investment financing, mergers and acquisitions, and foreign cooperation, and help pharmaceutical enterprises absorb, aggregate and integrate social resources.

(3) This study will measure the brand function index and brand strength by adding consumer factors, so that the interactive relationship between pharmaceutical enterprise brand and consumers can be reflected through brand value. Thus, it will promote the society and consumers to fully understand the brand value of China's pharmaceutical enterprises, establish the brand contract relationship between the products of pharmaceutical enterprises and consumers, and help enterprises to enhance the brand loyalty of consumers.

(4) It will bring market confidence and good expectation to the investors of China's pharmaceutical enterprises, activate the transaction of enterprise property rights, and improve the efficiency of investment and financing of pharmaceutical enterprises. Brand valuation can inspire investor confidence and encourage investors to make investment decisions. Through brand evaluation, investors can have a multi-angle understanding and correct view on the value of pharmaceutical enterprises, which can be correctly reflected in the financial reports of enterprises. So, it can enhance the confidence of investors, improve the efficiency of investment and financing transactions and help investors make effective investment decisions.

(5) Brand is an important symbol for pharmaceutical enterprises to guide customers to identify themselves and distinguish themselves from their competitors, which is the core competitiveness of pharmaceutical enterprises. Katharina, Adamantios, and Angeles (2008) think that branding is a key tool in a firm's differentiation strategy. So the significance of this study is not only to help pharmaceutical enterprises know the value of their brand equity, but

also to help them find the factors affecting brand equity, so as to achieve the goal of building strong brand equity and strengthening the core competitiveness of enterprises.

### 1.3 Research problem

Zhang (2015) demonstrates that due to the particularities of drugs, pharmaceutical companies are strictly controlled and restricted by the government departments in terms of drug production, sales, and publicity. How to stand out from various pharmaceutical products and become a high-quality “pharmaceutical brand” and win the favor of the market and consumers has become increasingly the primary issue facing pharmaceutical companies in China.

#### (1) Weak brand awareness of pharmaceutical companies

Meng and Guo (2012) point out that some pharmaceutical companies in China believe that the establishment of a brand is a matter in the future, and companies must focus mainly on survival for the moment while seek development in the future. They are short-sighted and focus on short-term profits, lacking long-term strategic planning, let alone “wasting” money on pharmaceutical brand strategy. In the pharmaceutical industry, most companies consider products as the core in the marketing process, and focus mainly on product specifications, external packaging images, and advertisement. Shan (2007) point out that the most fundamental problem of many China's pharmaceutical companies is that they do not genuinely make efforts to build the brand but consider it as a by-product while completing sales tasks. In the fierce market competition, they often eager for quick profits, so the brand has often been damaged in the process.

#### (2) Lack of innovation in pharmaceutical brands

Product innovation is the source of vitality for a brand. However, as for Chinese pharmaceutical companies, generally investment in R&D is insufficient, research and development capability is weak, and technological innovation is relatively backward. Network (2010) concludes among the 24 categories of more than 1,350 bulk drugs produced in China, more than 97% are generic drugs, and only two are self-developed and are internationally recognized (artemisinin and sodium dimercaptosuccinate). Zhang, Li, and Cheng (2013) pointed out that from the perspective of international experience, brand management in the US has gone through three stages: creating a brand - managing a brand-buying and selling a brand. Most pharmaceutical companies in China only pay

attention to “creating” brands and do not attach importance to “protecting, nurturing, and operating” them, leading to continuous depreciation of brand assets.

### (3) Lack of scientific brand valuation system

Pharmaceutical companies in China lack experience in “brand management”. Tong (2010) deems that the positioning of brand in the pharmaceutical industry is not precise enough, the brand recognition is limited, and the creation of featured brands is not duly valued, lacking pharmaceutical brands established based on enterprise culture and features, and there is little research on brand connotation, brand importance, brand composition, brand establishment and brand valuation method.

### (4) Lack of brand culture

In the final analysis, brand issues are cultural issues. Brand is the carrier of culture and culture is the soul of brand. The cultural connotation and symbolic significance of brand makes people believe in it. Fan (2013) contends that culture is the spiritual soil for brand building and it affects marketing decisions of companies as well as the consumption psychology, consumption pattern, consumption behavior and consumption behavior of consumers in a indirect and subtle way. According to Sheng (2013), the brand represents values and commitment. The formation of a pharmaceutical brand culture is critical to the long-term development of a brand. Some pharmaceutical companies in Shanghai lack planning the establishment of management ideas and values, often use short-term price promotions to solve market problems, and obtain immediate interests at the expense of long-term benefits. It will gradually sabotage the pharmaceutical brand base that has been established, engulf the basic spirit of honesty promised by the pharmaceutical brand, and make it impossible to establish pharmaceutical brand culture.

Therefore, an important reason why local Chinese brands are difficult to become a strong global brand is the lack of strategic brand management talents who can grasp the optimal combination of brands on a macro level and holistically plan and unify brand development strategies.

On the whole, the current research and exploration on the brand value of pharmaceutical companies in China reveals that a theoretical method system suitable for practical applications is yet to be established, and there is no practical experience in assessing brand assets in the pharmaceutical industry. Therefore, it is difficult to play a proper role in the management of pharmaceutical companies and meet the urgent requirements for the development of

pharmaceutical companies. As a result, it is urgent to build a brand value model and a brand value evaluation system suitable for China pharmaceutical companies to deal with the above problems.

#### **1.4 Research purpose**

This study will better understand the brand of pharmaceutical companies in China, using some survey data of Y Company as the sample data and will analyze these data case by case. Through research on factors affecting product brand value pharmaceutical companies in China, the study evaluates the weights of the influence of influencing factors on brand value, and at the same time, builds a model applicable to the brand value of pharmaceutical companies in China.

The establishment of the model can truly reflect the brand value of pharmaceutical companies in China, and will help companies to better understand the law of brand growth so they can implement brand strategy in the era of brand economy, accelerate brand innovation, optimize brand management, and provide high quality products and services for consumers as well as promote self-development of the companies. At the same time, it hopes to have a certain reference value for enriching the research on brand value of Chinese pharmaceutical companies.

#### **1.5 Research contents and framework**

The main content of this thesis is to sort out the relevant theories of brand value and brand value evaluation methods, and to revise the Interbrand model according to the characteristics of Chinese pharmaceutical industry, and to construct the brand value evaluation model of Chinese pharmaceutical industry. Taking Y Company of China as an example, this thesis makes a case study and analyses the rationality of the results of brand value evaluation. The study framework can be seen in Figure 1-1.

Chapter 1, first of all, elaborates the brand status of China's pharmaceutical enterprises, and analyses the main problems faced by China's pharmaceutical industry in brand management. As the brand strategy rises to national strategy, the competition among China's pharmaceutical industries is no longer product level competition, but higher brand level competition. Therefore, it is of great significance to construct a brand value evaluation system



suitable for China's pharmaceutical industry for optimizing enterprise brand management, establishing a scientific brand management concept, and comprehensively enhancing enterprise brand competitiveness. Then, this chapter analyzes the research methods involved in this thesis. Finally, the research content and framework of this thesis are also elaborated.

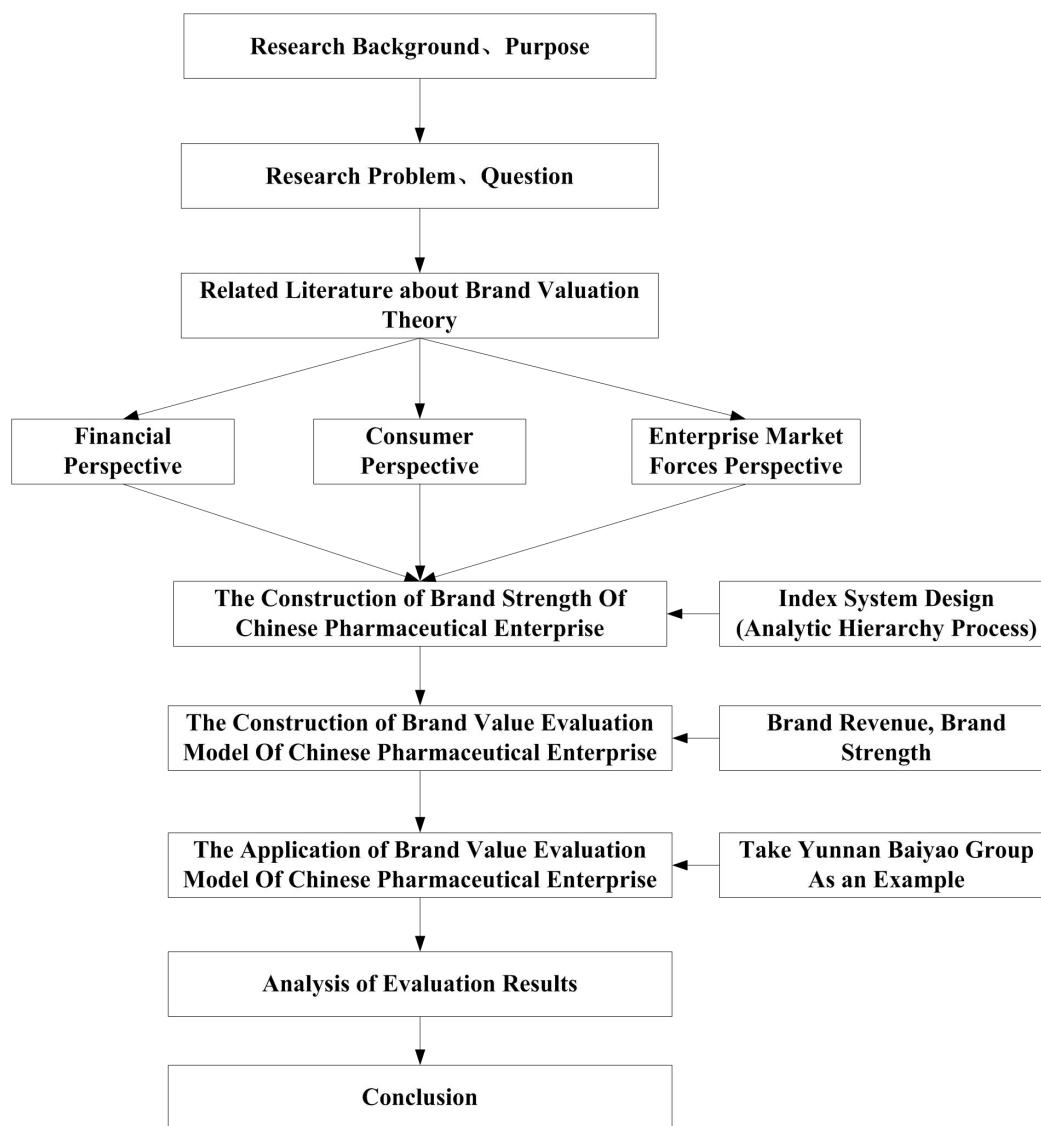


Figure 1-1 The study framework

Chapter 2 introduces the background of China's pharmaceutical enterprises in detail. Firstly, it introduces the characteristics and classification of China's pharmaceutical enterprises; secondly, it analyses the market environment of China's pharmaceutical enterprises, including the political, economic, social and technological environment that China's pharmaceutical enterprises are facing; next, this chapter also analyses the status quo

of global pharmaceutical industry and compares it with the current situation of China's pharmaceutical industry, and put forwards the necessity of implementing brand strategy in China's pharmaceutical enterprises. Finally, the way of shaping the brand of China's pharmaceutical enterprises is analyzed.

Chapter 3 mainly studies the literature review related to this thesis. Firstly, the theories of brand management, including the definition, classification, characteristics and related concepts of brand management are reviewed. Secondly, the theories of brand value, including the connotation, formation mechanism and characteristics of brand value are analyzed. Finally, the brand valuation methods based on different perspectives are elaborated and compared.

Chapter 4 mainly introduces the conceptual model of this thesis. Firstly, it analyzes the reasons for choosing the consumer perspective to establish the evaluation model. Secondly, it analyzes the applicability of Interbrand model and proposes its rationality. Thirdly, it introduces the improvement of Interbrand model.

Chapter 5 is the methodological chapter of this thesis. Firstly, it introduces the research methods of this study, including questionnaire survey, expert scoring, analytic hierarchy process and fuzzy mathematics. Then the calculation process of brand revenue and brand strength is improved according to specific research methods.

Chapter 6, taking the Chinese pharmaceutical company-- Y Company, as an example, applies the designed value evaluation model. Firstly, it introduces the basic situation of Y Company and its brand positioning. Secondly, it introduces the data sources in the brand value evaluation process of Y Company, and carries out the evaluation hypothesis and the evaluation benchmark date. Finally, it calculates the brand value of Y Company.

Chapter 7 analyzes the calculation results of the brand value of Y Company. The evaluation results of the model designed in this thesis are different from those published by Interbrand Company, Beijing Brand Asset Assessment Company and World Brand Laboratory. This chapter mainly analyses the rationality and difference of the calculation results.

Chapter 8 summarizes the research work of this study and puts forward some suggestions to enhance the brand value of Chinese pharmaceutical industry. Besides, the shortcomings of this thesis and the next research direction are also described.

## **1.6 Brief summary**

This chapter first elaborates the current brand situation of Chinese pharmaceutical

enterprises, and analyses the main problems faced by Chinese pharmaceutical industry in brand management in detail. Then it puts forward the importance of building a brand value evaluation system suitable for Chinese pharmaceutical industry, mainly from the theoretical and practical aspects. Then, this chapter analyses the dilemma faced in the research process and the research methods involved. Finally, the research content and framework of this study are elaborated in detail.

## **Chapter 2: Research Background**

### **2.1 Overview of pharmaceutical industry in China**

#### **2.1.1 Definition of pharmaceutical companies**

According to the definition of Article 102 of the Drug Administration Law of the People's Republic of China as amended by the Twelfth Standing Committee of National People's Congress (2015), the broad sense of pharmaceutical companies refers to companies in the pharmaceutical industry, which can be divided into drug manufacturing companies and drug trading companies. The so-called drug manufacturing companies refer to enterprises exclusively or partly engaged in drug manufacturing, while drug trading companies refer to enterprises exclusively or partly engaged in drug trading.

The pharmaceutical companies studied in this study are drug manufacturing companies, so the brand value of Chinese pharmaceutical companies discussed in this study is also limited to drug manufacturing companies in China.

#### **2.1.2 Characteristics of pharmaceutical companies**

The pharmaceutical industry is a sunrise industry. Driven by the strong R&D force, the pharmaceutical industry has become the fourth largest profit generating pillar industry in the global economic composition after information technology, finance and telecommunication, which is internationally recognized as a “never declining sunrise industry”. The barriers to entry in the pharmaceutical industry are high, mainly including policy barrier, capital barrier, technological barrier, and brand barrier.

(1) In terms of policy, drugs can only be produced after pharmaceutical companies obtain The Drug Manufacturing License and The Drug Registration Approval issued by relevant national regulatory authorities. Moreover, pharmaceutical preparations must meet GMP requirements. (GMP is the abbreviation of Good Manufacturing Practice in English. It is a management system that pays special attention to the implementation of product quality and health safety in the production process. It is a set of mandatory standards applicable to pharmaceutical, food and other industries.)

The clinical trials, licensing, production, transportation, sales, import and export of drugs are strictly regulated by the government. Liu (2017) points that the pharmaceutical industry, which concerns people's health and life safety, is highly related to laws, regulations and policies.

(2) In terms of capital, pharmaceuticals must undergo a series of links such as R&D, clinical trials, and trial production before they finally enter the circulation and are bought by consumers. In each of these links, a large amount of resources such as people, talents, and materials must be invested. The successful R&D of new drugs has great influence on pharmaceutical companies.

The high investment in the pharmaceutical industry is particularly evident in the research and development of new drugs. Wu (2019) point that the development of new drugs requires a large amount of capital investment and a long development cycle, and the difficulty of new drug research and development is obviously increased. According to the European Union of Pharmaceutical Industry Associations (2014), the research and development cycle of an innovative drug is 10-15 years, and the cost of research and development is about US\$1.2 billion. The R&D of new drugs requires a lot of capital investment and a long development cycle. In foreign countries, it usually takes \$250 million to develop a new drug abroad, some of which even up to \$1 billion in developed countries. The R&D expense of new drugs in pharmaceutical enterprises has accounted for 15% to 20% of their sales revenue. According to the R&D Input Ranking List in 2017 published by European Commission (2017), the pharmaceutical and biotech industries make up 24 of the top 100 companies, with ROCHE, JOHNSON, and JOHNSON and NOVARTIS in the top 10.

As shown in Table 1 in Appendix 2.

(3) In terms of technology, the R&D link is a key link that pharmaceutical companies need to grasp to gain competitive advantage in market competition. According to Standing Committee of National People's Congress (2015), investments in new drugs range from pre-clinical, prescription and stability trials such as synthetic extraction, biological screening, pharmacology, toxicology, bioavailability testing and magnification testing to clinical trials in humans, registration, marketing and after-sales supervision. In the whole steps, the production equipment and the production technology must meet certain standards. Drug R&D and Listing Process is shown in Figure 1 in Appendix 1.

(4) In terms of brand, for the pharmaceutical industry, strong brands are the source of pharmaceutical company's core competitiveness. The pharmaceutical industry is a special

industry, as its brand building and brand marketing are based on its contribution to health and defeat of diseases. Any false or off-the-shelf hype will exert a great impact on people's health and will even take their lives. Any short-sighted behavior will have an impact on the long-term development of brand and any false acts are also disrespect and contempt to life. So the pharmaceutical companies are faced with the pressure of profit creation and self-development, as well as shouldering social morality and social responsibility.

Therefore, Xu, Deng, Feng, and Lei (2017) conclude that the brand equity of pharmaceutical companies should be based on brand marketing behaviors that have been tested in numerous health care or clinical practices, have been fully trusted by customers, and have created added value for them. Such brands shall form a long-term unique image in the minds of customers.

### **2.1.3 Type of pharmaceutical company**

Pharmaceutical industry is mainly engaged in traditional Chinese medicinal materials, chemical raw materials and preparations, biochemical drugs, biological products, antibiotics, sanitary materials, radio pharmaceuticals, medical devices and other business industries. It is the combination of primary industry, secondary industry and tertiary industry, which is an important product of the combination of modern industry and traditional industry. It plays an extremely important role in resolving people's health problems, protecting people's health, prolonging life span and improving people's quality of life. (Primary industry, Secondary industry and Tertiary industry: According to the classification method of the United Nations, the primary industry includes agriculture, forestry, animal husbandry and fisheries; the secondary industry includes manufacturing, extractive industry, construction and public engineering, hydro-power, oil and gas, pharmaceutical manufacturing; and the tertiary industry includes commerce, finance, transportation, communications, education, services and other non-material production sectors.)

China's pharmaceutical enterprises are playing an increasingly important role in the global pharmaceutical market. In 2001, China ranked tenth in the world in terms of drug consumption market, while since 2013, China has become the world's second largest drug market after the United States, and China is the world's largest producer and exporter of chemical raw materials medicine. By 2016, Chinese pharmaceutical industrial enterprises that were included in the National Bureau of Statistics (2017) were distributed in six sectors.

#### **2.1.4 Classification of pharmaceutical products**

According to The Administrative Measures on Classification of Prescription Drugs and Non-prescription Drugs issued by The National Medical Products Administration of PRC (2010), drugs produced by Chinese pharmaceutical manufacturers can be divided into prescription drugs and over-the-counter (OTC) drugs from the perspective of government administration.

**Prescription Drugs:** Drugs that can be dispensed, purchased and used must be prescribed by a licensed physician or a licensed assistant physician. It is characterized by the fact that consumers cannot purchase by themselves, and that they must be licensed by professionals.

**OTC drugs:** drugs that consumers can judge, buy and use on their own. OTC drugs are classified into two categories: A and B. Among them, Class A can only be sold in pharmacies, while Class B can be sold in supermarkets, hotels or department stores.

At present, prescription drug sales still occupy the main market share. However, a growing number of patent drugs that fail to patent are being applied for conversion to OTC sales. With the improvement of consumers' awareness of self-care, the development of OTC drug market has become faster and faster. In the case of drug safety, the government is also pushing forward this transformation.

### **2.2 The market environment analysis of Chinese pharmaceutical industry**

Pharmaceutical industry is closely related to people's health and life safety. The clinical experiments, market license, production, transportation, sales, import and export of drugs are strictly regulated by the government. It is an industry with high degree of relevance to laws, regulations and policies. In terms of the attribution of industry types, according to the high-tech industries manufacturing classification released by National Bureau of Statistics of China (2017) and the emerging industries classification released by National Bureau of Statistics of China (2018), "pharmaceutical manufacturing" is both a high-tech manufacturing industry and a strategic emerging industry type, which is an important component of the biological industry.

This study analyzes the market environment of China's pharmaceutical enterprises from four aspects: political environment, economic environment, social environment and technological environment, as shown in Figure 2-1.

### 2.2.1 Political environment

#### (1) Policy support

Chinese pharmaceutical industry is related to the national economy and the people's livelihood, which is highly valued by the government. The Chinese government has successively promulgated “*The Pharmaceutical Science and Technology Policy*” and “*The Guidelines on Promoting the Healthy Development of Pharmaceutical Industry*” and other related policies, which reflect the great attention paid by the Chinese government to the pharmaceutical industry.

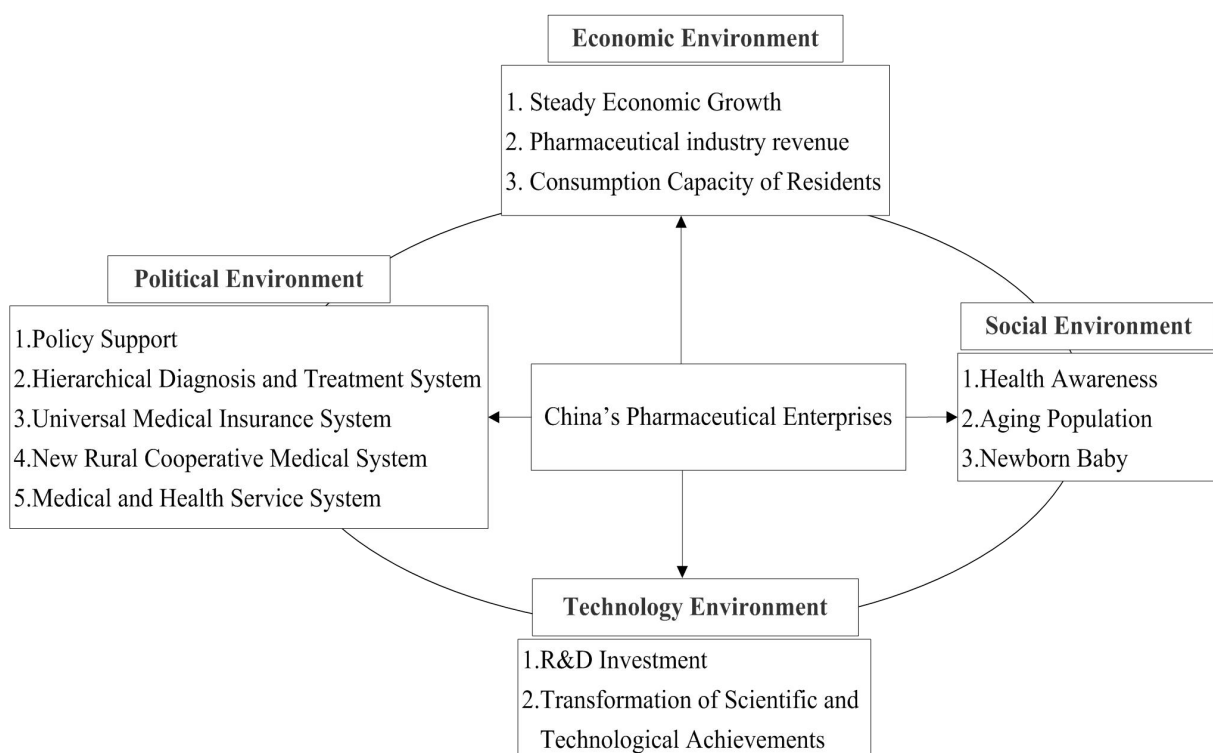


Figure 2-1 The market environment of China's pharmaceutical enterprises

In August 2016, at the national health and health congress (2016), the Chinese President Xi Jinping points out that people's health should be placed on our development agenda as a strategic priority and the construction of healthy China should be accelerated. As a strategic emerging industry best suited to the needs of people's overall development with the greatest potential and impetus in the 21st century, big health covers the first, second and third industries, including green food, medical production, medical service, health care and old-age care, leisure tourism and rehabilitation treatment, and has become the largest emerging industry in the world.



In order to promote healthy China, The State Council of the People's Republic of China (2016b) issued *The Outline of Healthy China 2030* in October 2016, which is the action program for China to promote healthy China in the next 15 years. The outline clearly proposes to strengthen the innovation capacity building of patented drugs, new drugs of traditional Chinese medicine, new formulations and high-end medical devices, and promote the generic medicines of expired drugs for the treatment of major diseases to be on the market. The Outline sets the target that by 2020, the overall scale of health service industry in China will exceed 8 trillion yuan and reach 16 trillion yuan by 2030.

The “Thirteenth Five-Year Plan” of China clearly states that China will actively promote the construction of a “healthy China”, deepen the reform of health care, and practice the “three medical linkages” of medical insurance, medicine and medical treatment. (The “Thirteenth Five-Year Plan” of China: China began to make its first "five-year plan" in 1953. The 13th Five-Year Plan is the 2016-2020 year. Planning is mainly to plan major construction projects, productivity distribution and important proportion of the national economy, and to set goals and directions for the development of the China’s economy.) At this important time node, China's pharmaceutical industry has shown a good momentum of development in the face of globalization and has made tremendous contributions to improving the life quality of the people and developing the health care service in China. The State Council of the People's Republic of China (2017) issued *The Key Tasks for Deepening the Reform of the Pharmaceutical and Health Care System* in 2017, noting that the year of 2017 is key to implementing the spirit of the National Health Conference and deepening the pharmaceutical and health care system reform planning in the “Thirteenth Five-Year Plan” of China. The key tasks of medical reform in China are mainly focused on the establishment of five basic medical and health care system frameworks including hierarchical diagnosis and treatment, modern hospital management, universal medical insurance, drug supply support, and comprehensive supervision.

In terms of strategic management of Chinese pharmaceutical brands, China has also issued policy documents, such as The Outline of the National Intellectual Property Strategy promulgated by The State Council of the People's Republic of China (2008), which stressed the importance of Chinese brand asset management. The management of brand assets should be based on the creation, utilization, protection and management of brands, and reveal corporate brand development pattern through the evaluation of corporate brand operations so as to guide companies to effectively implement brand strategy. To achieve this management

goal, as Michael (2004) said, the key lies in how to reasonably measure the value of corporate brands, reveal the current status of Chinese corporate brand management, analyze the advantages and disadvantages of companies in brand operations, and guide enterprises to increase their brand competitiveness. *Opinions on Giving Full Play to the Role of Brand to Promote the Supply and Demand Structure Upgrading* promulgated by The State Council of the People's Republic of China (2016) stressed that giving full play to the leading role of brand and promoting supply and demand structure upgrading are conducive to stimulating innovation and creativity in enterprises, promoting the rational allocation of production factors and improving the quality of supply system; leading consumption, creating new demands, establishing consumer confidence in self-owned brand, and meeting people's higher level of material and cultural needs; promoting honesty and trustworthiness of enterprises, strengthening corporate social responsibility and achieving more harmonious, equitable and sustainable development.

(2) The establishment of hierarchical diagnosis and treatment system

*The Guiding opinions on promoting the construction of hierarchical diagnosis and treatment system* issued by the General Office of the State Council of PRC (2015) aims at improving the capacity of grassroots medical services, optimizing the allocation of resources, and making the quality medical resources sharing. This opinion takes the hierarchical diagnosis and treatment of common diseases, frequently-occurring diseases and chronic diseases as a breakthrough point, perfects the service network, operation mechanism and incentive mechanism, forms a scientific and reasonable medical order, and effectively promotes the fairness of basic medical and health services. Subsequently, *the Notice on Promoting the Pilot Work of Hierarchical Diagnosis and Treatment* issued in 2016 ensures that Beijing and other 4 municipalities and Shijiazhuang and other 266 prefecture-level cities as pilot cities, which can further strengthen the capacity-building of grass-roots medical and health institutions and county hospitals.

The construction of hierarchical diagnosis and treatment service system is an important measure to rationally allocate medical resources and promote the equalization of basic medical and health services in China. It is also an important content to deepen the reform of medical and health system and establish the basic medical and health system with Chinese characteristics. It is of great significance to promote the long-term and healthy development of medical and health undertakings.

(3) The universal medical insurance system

Development of the China's medical insurance system mainly includes completing of the integration of the basic medical insurance system for urban and rural residents, implementing the “six-unification” policy and rationalizing the management system; promoting the establishment of a diversified and compound payment method led by payment by Diagnostic Related Groupings; promoting medical insurance information sharing nationwide so that expenses of hospitalization in other places that is in line with the referral requirements can be settled directly; supporting commercial insurance agencies to participate in medical insurance management. Universal medical insurance and diversified compound payment methods are conducive to the rapid development of the overall pharmaceutical industry.

#### (4) The new rural cooperative medical system

The National Health and Family-Planning Commission and Finance Ministry of China (2017) issued Notice on the Work of New Rural Cooperative Medical System in 2017. The implementation of the policy will further improve the standard of medical financing, help poverty alleviation, and increase the support for the serious illness insurance. He (2017) points that nowadays, faced with medical problems, farmers are no longer worried about high medical expenses. They can reimburse outpatient and hospital expenses as long as they are in designated medical institutions, and the proportion of reimbursement for the two expenses is stable at about 50% and 75% respectively. Moreover, because of the large number of farmers, the increase of the proportion of medical expenditure has occupied a place in the field of rural medical market.

#### (5) Medical and health service system

At present, China's medical and health service system has initially established a three-tier medical system covering urban and rural areas composed of hospitals, grass-roots medical and health institutions and professional public health institutions. The outline of the national medical and health service system (2015-2020) issued by the General Office of the State Council of PRC (2015b) promoted the further optimization of allocation of China's medical and health resources and promoted the vertical development of China's medical reform. According to China Statistical Yearbook issued by National Bureau of Statistics of China (2016), by the end of 2015, China had 983,500 medical and health institutions, including 27,600 hospitals, 920,800 grassroots medical and health institutions, and 319,000 professional public health institutions. The number of medical institutions increased somewhat compared with 2014.

### 2.2.2 Economic environment

With the continuous improvement of people's requirements for health level, there is a growing demand for the pharmaceutical industry, and there is also a huge space for the economic development of the pharmaceutical industry. At present, China's pharmaceutical industry has entered a mature stage of development, with the production scale and market capacity expanding constantly.

#### (1) Steady economic growth

After more than 10 years of macroeconomic adjustment, China's economy is now growing at a steady pace and prices are rising again. All kinds of economic signs show that China's national economy will enter a long-term upward trajectory, which also provides a good macroeconomic environment for the development of China's pharmaceutical enterprises. China's GDP data in the past decade is shown in Figure 2 in Appendix 1.

#### (2) The revenue of the pharmaceutical industry increases year by year.

Since the China's reform and opening up, China's pharmaceutical industry as a whole has maintained rapid growth. (Reform and opening up: The Chinese government formulated policies to promote the development of social productive forces after 1978. Reform means reform at home and opening up means opening up to the outside world. Reform and opening-up have established a socialist market economy system, which has brought about tremendous changes in China.)

From 1978 to 2007, the output value of the pharmaceutical industry increased by 16.1% annually. While from 2007 to 2017, the output value of the pharmaceutical industry increased by 18.7% annually. The comprehensive strength of sub-industries such as chemical pharmaceutical manufacturing, traditional Chinese medicine and Chinese patent medicine processing, biological products manufacturing and medical equipment and equipment manufacturing has been gradually enhanced, and the economic operation quality, scale and efficiency of the pharmaceutical industry have been continuously improved. Affected by the sound operation of the Chinese macroeconomic environment, the overall operation of the pharmaceutical industry showed a development trend of sustained growth of industrial production, sound commercial sales, and steady improvement of efficiency.

#### (3) The increasing consumption capacity of residents

With the continuous growth of China's per capita income, the consumption structure of Chinese residents began to change from material consumption to service consumption. In the

context of the upgrading of consumption concepts, healthy consumption has become one of the core demands of residents for service consumption. Increased affordability of residents in the field of disease treatment has led to wider and wider coverage of pharmaceutical products.

The factors influencing medical demand largely depend on the per capita income. With the improvement of people's living standards, the per capita disposable income and per capita consumption expenditure of Chinese residents have increased steadily. According to National Bureau of Statistics (2017), the per capita disposable income of Chinese residents was close to 26,000 Yuan, with the year-on-year growth of 9.04 percent, and the per capita consumption expenditure was over 18,000 Yuan, with the year-on-year growth of 7.08 percent. Among them, people's investment in health management has grown by more than 11% on average in the past five years, slightly higher than the growth of disposable income and consumer spending. The per capita disposable income and consumption expenditure of China's residents in the past five years are shown in Figure 2-2.

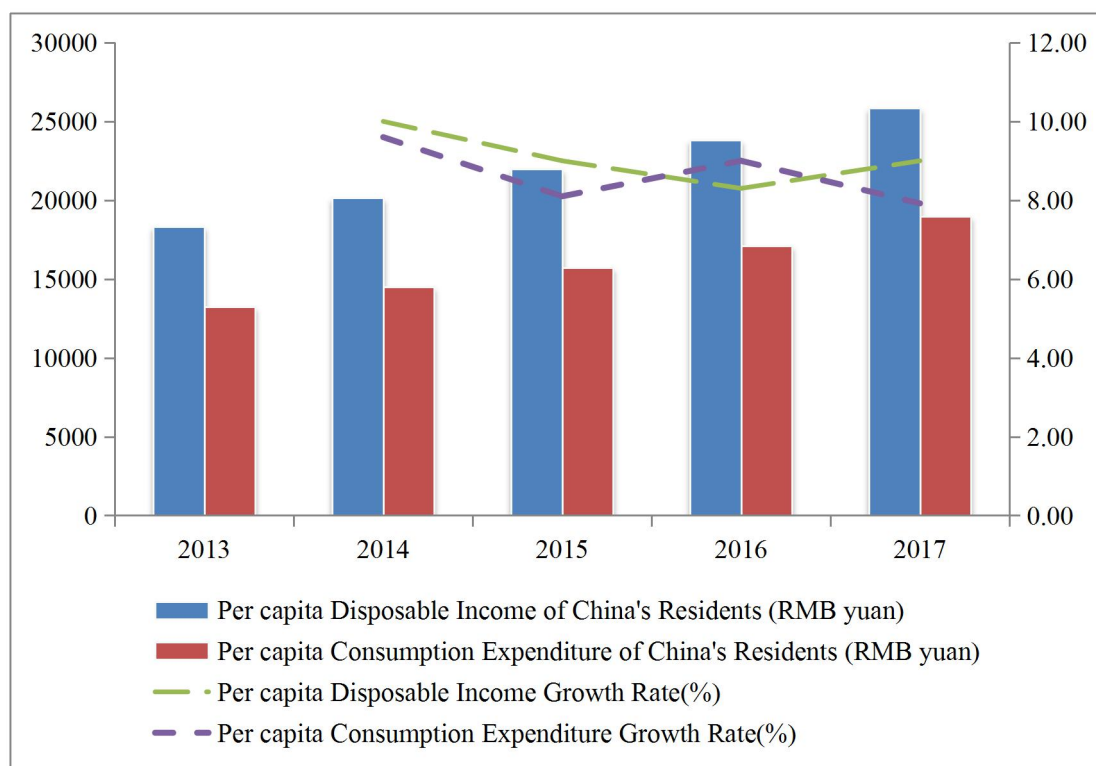


Figure 2-2 Per capita disposable income and consumption expenditure of China's residents

### 2.2.3 Social environment

In recent years, the growth of China's population, especially the aging population problem, has increasingly expanded the pharmaceutical market. At the same time, China's pharmaceutical product R&D innovation is insufficient, which is a challenge and an

opportunity for the development of Chinese pharmaceutical industry. As the pillar industry of China's national economy, the pharmaceutical industry is not only related to the health of the general public, but also to the stability and order of society.

(1) The growing health awareness

With the continuous progress of human civilization and the improvement of education level, the overall quality of China's population has been continuously improved, and people pay more and more attention to health. The concept of social consumption has also changed from treating diseases to health care prevention. At the same time, people pay more attention to the choice of medical products and medical drugs and tend to choose the medicine with good reputation. The price of medicine is not the only determinant factor. Various trends show that the Chinese pharmaceutical market will be expanded, which has become the focus of attention.

(2) The increase aging of population

According to National Bureau of Statistics (2017), by the end of 2017, the Chinese population had reached 1.39 billion, and the net population growth will generate new demand for pharmaceutical products. With the continuous social and economic development, people's health awareness has also been increasingly improved. In addition, with the advent of an aging era, people's purchasing power and consumption of drugs have also increased significantly. The elderly are the main consumer groups of medical and health income. The rapid growth of this group will stimulate the growth of demand for medical services, and bring new opportunities and challenges to the pharmaceutical industry.

According to statistics of Press Conference released by Office of the National Commission on Aging (2018), In 2015, the number of people over 60 years old in China exceeded 222 million, accounting for 16.15% of the total population. By the end of 2017, there were 241 million people aged 60 or above in China, accounting for 17.3 percent of the total population. It is estimated that the number of elderly people will exceed 255 million in 2020, and the proportion of the population over 60 years old will reach 17.95% by then. The population of people over 60 years old is expected to surpass 300 million in 2025, and China will become an ultra-elderly country. Due to the low immunity of the elderly population, the morbidity rate is high. In addition, the elderly are often suffering from chronic diseases, which require continuous drug use and higher cost. Therefore, the elderly population will put forward higher requirements for medical and health services, and bring unprecedented development opportunities for the China's pharmaceutical industry. The number and

proportion of population over 60 years old in China in the past 10 years are shown in Figure 3 in Appendix 1.

(3) The surge of newborn baby

According to China Industrial Development Research Network (2016), in 2010 to 2014, there were about 16 million newborns babies in China every year. After the full implementation of the two-child policy, the number of newborns is expected to increase by about 5 million per year in the first five years. There are about 6,000 pharmaceutical enterprises in China, but only about 10 specialized children pharmaceutical enterprises. The population under 12 years old in China has exceeded 200 million, and the children's immune system is in the initial stage of development, belonging to the vulnerable and susceptible groups. The market demand for children's medicine is huge, which contains numerous development opportunities and huge space for innovation.

#### **2.2.4 Technology environment**

(1) The R&D investment is low.

Pharmaceutical manufacturing industry is a high-tech industry, and product development plays an important role in it. As long as the most advanced product development technology is mastered, technical barriers will be formed. During the patent protection period, it can bring huge excess profits for enterprises. Patent technology is the basis for the survival and development of the pharmaceutical industry. If the intellectual property right is not protected, innovation will inevitably be curbed. Due to the low level of technological innovation of China's pharmaceutical enterprises, the small and medium-sized pharmaceutical enterprises are unable to carry out the R&D of innovative products with completely independent intellectual property rights. Most of them focus on the innovation and research of generic drugs and take the road of imitation innovation, which makes the gap between Chinese medicine and international medicine increasingly large. Chen, He, Xu, and Zhang (2017) held that at present, the overall strength of China's pharmaceutical enterprises is not strong enough, scientific research capacity is very weak, and the conditions for the creation and manufacture of new drugs are not sound. Market survey shows that the R&D investment of China's pharmaceutical enterprises accounts for 5% of the sales revenue, while the R&D investment of global large pharmaceutical companies generally accounts for 20% or more. As the market of high-end pharmaceutical products has been occupied by foreign companies, it is difficult for China's pharmaceutical enterprises to gain market share and profit from this industry.

(2) The transformation rate of scientific and technological achievements is low.

Chai and Wang (2018) propose that in terms of transformation of scientific and technological achievements, at present, the transformation rate in China is only 10% ~ 30%, which is far lower than the level of 70% in developed countries. In order to change this situation, since 2015, China has guided the transformation of scientific and technological achievements from the policy level by revising legal provisions, formulating supporting rules and deploying specific tasks, such as *Law of the People's Republic of China on the Promotion of Transformation of Scientific and Technological Achievements*, *Action Plan for Promoting Transformation and Transfer of Scientific and Technological Achievements*. Besides, in order to speed up the restructuring and upgrading of Chinese pharmaceutical industry, the Ministry of Industry and Information Technology of China (2016) formulated *the Guidelines for Pharmaceutical Industry Development Planning*, which regards enhancing technological innovation ability as one of the development goals. Therefore, technological research ability is becoming more and more important for the development of pharmaceutical enterprises.

With the development of society, the types and forms of diseases are becoming more and more complex. At present, many diseases such as hypertension, cancer, diabetes have not been better treated. Therefore, China's pharmaceutical enterprises need to constantly develop new drugs that are beneficial to human health and make greater contributions to human beings.

## **2.3 The status quo of the pharmaceutical industry**

### **2.3.1 The status quo of global pharmaceutical industry**

(1) The global pharmaceutical market is growing steadily.

Influenced by the aging of the population and the declining environmental quality, the global pharmaceutical market has shown a steady growth trend over the past decade. In 2015, the global pharmaceutical market has exceeded \$1 trillion, with a year-on-year growth rate of 4% (China Reporting Network, 2017). As shown in Figure 4 in Appendix 1.

(2) The sales distribution area is relatively concentrated.

North America, Europe and Japan are the three leading pharmaceutical markets in the world today. In terms of geographical distribution, North American was the largest market in the world in 2017, accounting for nearly 40% of the global pharmaceutical market. Europe's



share in the global pharmaceutical market was 22% and Japan was 8%. China contributes to the major pharmaceutical market increments, accounting for 20% of the global pharmaceutical market. Influenced by population growth, economic development and the gradual popularization of various new drugs in developing countries, the development speed of emerging pharmaceutical markets is significantly faster than that of developed countries (China Reporting Network, 2018).

(3) Large pharmaceutical enterprises are distributed in developed countries.

According to the statistics of global pharmaceutical enterprises, among the Top 50 global pharmaceutical enterprises sales in 2017, the number of pharmaceutical enterprises in the United States was the largest, reaching 16 enterprises, with Pfizer, Merck & Co., Johnson & Johnson, Gilead Science, AbbVie as typical representatives. There were 10 pharmaceutical enterprises in Japan which were among the Top 50 global pharmaceutical enterprises sales, represented by Takeda, Astellas, Pharma, Daiichi Sankyo, Otsuka Holdings. In addition to the United States and Japan, some European countries, represented by Germany, Switzerland, also have some pharmaceutical enterprises in the Top 50. Quantity Distribution of Global Top 50 Pharmaceutical Enterprises Sales in 2017 is shown in Figure 5 in Appendix 1.

According to the sales scale of global pharmaceutical enterprises in 2017, the 16 pharmaceutical enterprises in United States achieved sales of \$293.934 billion, accounting for 45.06% of the Top 50 global pharmaceutical enterprises sales. The United States has a strong competitive position among global pharmaceutical enterprises. Switzerland has only three pharmaceutical enterprises in Top 50, which are Novartis, Roche and Ekron, however, they generated sales of \$85.561 billion, ranking second in total sales. The three pharmaceutical enterprises in Switzerland also have a strong global competitive power. As for other countries, the Sales of each country accounted for less than 10%. It can be seen that, at the present stage, a relatively stable competition pattern has been formed in the global pharmaceutical enterprise market. As shown in Figure 6 in Appendix 1.

(4) The pharmaceutical industry attaches great importance to innovation.

R&D intensity refers to the proportion of R&D investment to enterprise sales. At present, most countries use R&D intensity to measure the innovation strength of the industry. Erickson and Jacobson (1992) maintain that if enterprise do not have innovative products, the most attractive advertising is invalid. The data from Prospective Industry Research Institute (2018) shows, among the Top 50 global pharmaceutical enterprises sales in 2017, the total R&D investment of pharmaceutical enterprises in United States achieved \$52.47 billion, which is

the country with the highest R&D investment. Its R&D intensity is 17.85%. In addition, except the French and Irish, the R&D intensity of pharmaceutical enterprise of other countries is above 15%. As shown in Figure 7 in Appendix 1.

Prospective Industry Research Institute (2018) also shows that, from the proportion of R&D investment of per country to total R&D investment of Top 50 global pharmaceutical enterprise in 2017, pharmaceutical enterprise in the United States account for the highest proportion, reaching 3.09%. Followed by Switzerland, its R&D investment accounted for 14.03%, and the rest of the countries accounted for less than 10%, as shown in Figure 2-3.

① American pharmaceutical enterprises have strong R&D capability, which is the mainstay of innovation.

In terms of R&D investment, the pharmaceutical industry is the most intensive industry in the United States. Every year, American pharmaceutical enterprises invest huge amounts of money into the R&D of new drugs. In 2017, the Merck Group spent 6.483 billion euros on R&D investment, with the R&D intensity of 17.2% (Wang & Feng, 2015).

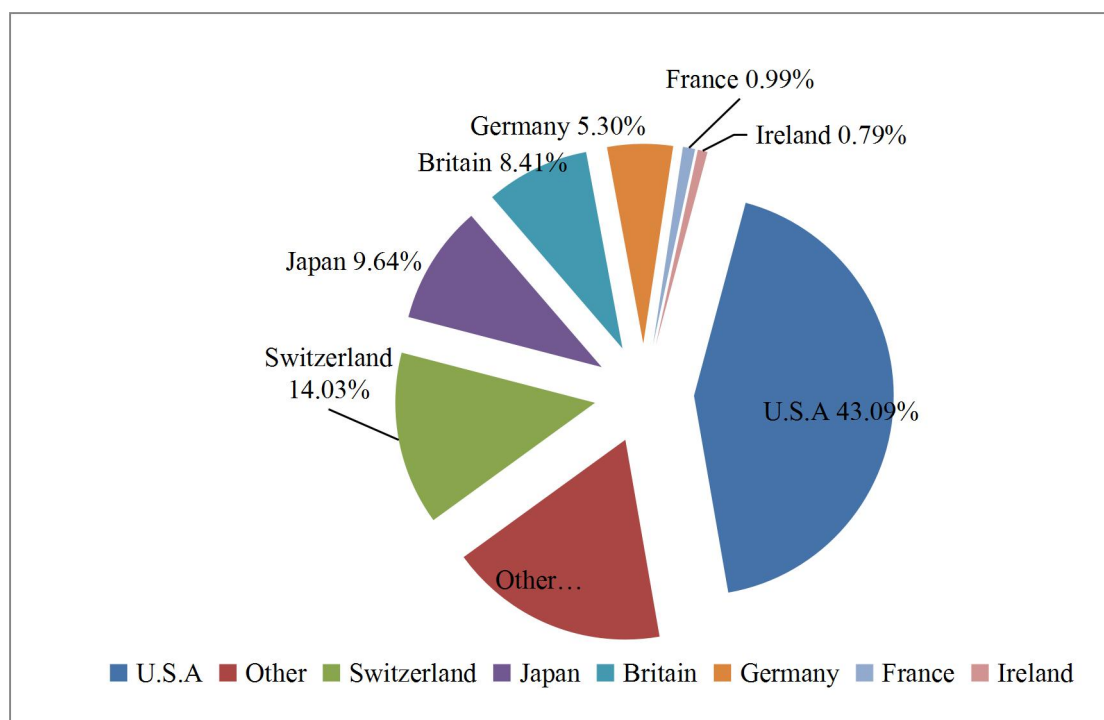


Figure 2-3 Proportion of R&D investment of per country to total R&D investment of top 50 global pharmaceutical enterprises in 2017

Source: Prospective Industry Research Institute (2018)

② Swiss enterprises focus on R&D investment to promote industrial innovation.

Switzerland is the country with the highest per capita spending on research and

development in the world. Fan (2015) points that the total annual R&D investment amounts to tens of billions of Swiss francs, accounting for about 2.7% of the gross national product. Among these R&D expenditures, only one-quarter of the investment from the government and scientific research institutions, the investment from enterprises is much higher than the government, accounting for about 80% of the total R&D expenses.

③ The innovation system of Japan's pharmaceutical industry is a combination of “government, industry, study and research”.

The characteristics of the innovation system of Japan's pharmaceutical industry are as follows: government plays a decisive role; enterprises are the main body of innovation. Universities and scientific research institutions cooperate closely with enterprises to promote the development of pharmaceutical industry.

④ German enterprises are the mainstay of innovation, and pharmaceutical enterprises are closely cooperated.

Germany is an old country in the pharmaceutical industry. Its pharmaceutical industry has mainly risen and developed from the “synthetic dyestuff industry”, which is also the main source of the modern world pharmaceutical industry. Germany is one of the earliest countries in the world to set up specialized research and development institutions, which are an important part of the innovation system of the pharmaceutical industry.

(5) The expiration of pharmaceutical patents is profoundly changing the landscape of the global pharmaceutical industry.

Pharmaceutical patent is a kind of protection of innovation in pharmaceutical industry by law. The market monopoly right of pharmaceutical sales derived from patent right is also an incentive to innovation. Due to the reliance on patented products, multinational pharmaceutical giants present a network of patent protection for their products, not only for the pharmaceutical compounds, but also for similar compounds, preparation methods, uses, dosage forms, crystal forms, etc. Implement patent protection to protect these important products like a net. However, Qin Mai Consultation (2018); Liu and Qiu (2013) hold that since the price of the generic drugs after the expiration of the patented drugs is usually only 20-80% of the same type of patented drugs, the impact and competition of patent expiration on the pharmaceutical giants is very fierce.

(6) Global pharmaceutical enterprises value brand strategy and have high brand value.

The global brand management theory has been studied very early and always keeps pace

with the changes of competition situation. At present, the theory of enterprise brand management tends to be perfect. In the “Top 500 Most Valuable Brands in 2017” list published by Brand Finance, a well-known brand evaluation agency in the United Kingdom, 17 pharmaceutical enterprises brands are among the top 500. The evaluation dimensions include public familiarity, loyalty, promotion activities, marketing investment, employee satisfaction and corporate reputation and so on. The global top 500 brand value ranking in pharmaceutical industry in 2017 is shown in Table 2 in Appendix 2.

As can be seen from Table 2-3, 17 pharmaceutical enterprises rank among the top 500. From the perspective of industry category, there are 4 enterprises in the pharmaceutical industry, 7 enterprises in the healthcare service industry, 2 enterprises in the pharmaceutical retail industry, and 1 enterprise in the medical technology industry. From the perspective of the state, there are 13 enterprises in the United States, 2 enterprises in Germany, 2 enterprises Switzerland, and none in China. It can be seen that there is still a big gap between Chinese pharmaceutical enterprises and European and American pharmaceutical enterprise in terms of brand value.

### **2.3.2 The status quo of Chinese pharmaceutical industry**

For China, with the enhancement of national consciousness of health care, the continuous improvement of medical insurance system and the improvement of per capita medication level, the China's pharmaceutical market will show a long-term growth trend. In the new era, facing new opportunities and challenges, China's pharmaceutical enterprises need to respond actively in order to seek sustainable development.

(1) China's pharmaceutical market revenue and profits grow steadily.

In the future, the development of China's pharmaceutical industry will face many favorable conditions, including the continuous improvement of urbanization level, the improvement of rural medical conditions, the increasing income of residents, the accelerated upgrading of consumption structure, and the strong support of the government for the pharmaceutical industry. Zeng (2014) states that China will become the second largest pharmaceutical producing country in the world by 2020, only next to the United States, which provides a good economic environment for the development of China's pharmaceutical enterprises.

According to *the Analytical Report on Market Prospects and Investment Strategic Planning of China's Pharmaceutical Industry in 2018-2023* issued by Prospective Industry

Research Institute, the total sales revenue and profits of China's pharmaceutical manufacturing industry in 2017 were 2982.6 billion yuan and 351.97 billion yuan respectively, which increased by 6.28% and 17.21% compared with the previous year. In recent years, the annual sales revenue and profits of China's pharmaceutical industry have been increasing, and the growth rate of profit is faster than that of sales revenue. As shown in Figure 8 in Appendix 1.

(2) The distribution area is relatively centralized.

According to Qian Xun Consultation (2018), China's pharmaceutical industry is mainly concentrated in Central China, North China and Northeast China. Taking 2017 as an example, the output value of the pharmaceutical industry in East China is about 1185.2 billion yuan, accounting for 33.2% of China's total output value; the output value of the pharmaceutical industry in North China reaches 624.7 billion yuan, accounting for 17.5% of China's total output value; and the output value of the pharmaceutical industry in Northeast China reaches 489.1 billion yuan, accounting for 13.7% of China's total output value. As shown in Figure 9 in Appendix 1.

(3) The number of large pharmaceutical enterprises is small.

China's pharmaceutical manufacturing enterprises are generally small in scale. Chen and Wang (2017) point out, compared with the developed countries, the proportion of large pharmaceutical enterprises in China is small, and the concentration of pharmaceutical enterprises is low, so it is difficult to form economies of scale. According to the Top 500 Chinese Enterprises in 2017 issued by the China Enterprise Confederation and the China Enterprise Directors Association (2017), only 9 pharmaceutical enterprises have been on the list. As is shown in Table 3 in Appendix 2.

(4) R&D investment and innovation ability is low.

The R&D pattern of medicine in China is quite different from that in developed countries. Luo, Sun, and Zhou (2016) think that China's pharmaceutical enterprises have long been confined to the production of generic medicines and lack of innovative experience and awareness of intellectual property protection. Many pharmaceutical enterprises in China do not have their own independent R&D institutions or their R&D intensity is low, which are the main reasons for their weakness in international competition. In 2018, the Top 100 China's Pharmaceutical Industry List released by The Ministry of Industry and Information Technology of China (2018) showed that the total R&D investment of China's Top 100

pharmaceutical enterprises was 31.6 billion yuan, accounting for only 4.2% of sales revenue.

(5) The homogenization of products is serious.

Homogeneity of products refers to the phenomenon that products of different brands in the same category are identical or similar in performance, appearance and even marketing means. Sun, Wang, and Jiang (2015) propose that China's small and medium-sized pharmaceutical enterprises are generally constrained and bound by the scale of enterprises, capital and traditional concepts. The Sci-tech input is seriously insufficient, the old technology is backward, and the foundation for R&D of new drug is weak. Various factors have caused the generic drugs to occupy a dominant position in China's small and medium-sized pharmaceutical enterprises. For example, 97% of the varieties of chemical APIs are "imitation" products. Some products such as gentamicin, paracetamol, vitamin B1, metronidazole and other preparations are produced by dozens or even hundreds of enterprises.

(6) The brand management of China's pharmaceutical enterprise is weak.

There are some problems in brand construction and management of China's pharmaceutical enterprises, including insufficient brand marketing and planning, vague brand recognition, neglect of brand culture construction, and lack of protection of brand patents.

① The overall brand marketing planning of China's pharmaceutical enterprises is insufficient.

Many pharmaceutical enterprises in China spend more on product promotion, but lack of effective overall marketing measures. The majorities of pharmaceutical enterprises have a misunderstanding in brand management, thinking that brand marketing is means advertising and raising popularity. They do not realize that the lack of sustained drug brand image maintenance will reduce consumer loyalty to corporate products, and will make business managers lack the concept of building strong brands. Guo, Guo, Yang, and Rao (2006) consist that China's pharmaceutical enterprises should study the brand status of China's pharmaceutical enterprises and introduce the western mature brand management theory as soon as possible, consciously follow the inherent law of brand establishment and development, and learn to manage their own brands.

② Many pharmaceutical enterprises have a vague understanding of the brand cognition.

Many pharmaceutical enterprises consider that building the brand is a matter of the future and the current key task is to survive. Such enterprises lack long-term strategic planning and will not "cost" for the construction of pharmaceutical brand projects. Wang

(2010) points out that many medical brands hope to be known overnight. Driven by the mentality of eager for quick success and the vague cognition of pharmaceutical brands, they often spend a lot on promoting the popularity of brands in the early stage, but they are weak in the maintenance and management of brands in the later stage, which leads to the establishment of the brand without results.

③ Ignore product quality

Many China's pharmaceutical enterprises are keen to build their own brands, but the fact is that while they are building their brands, they overlook quality management because of one-sided pursuit of output, eventually devaluing the intangible assets of the enterprises. The survey shows that there is still a certain gap between the qualified rate of China's pharmaceutical products and that of developed countries.

④ Neglect brand culture construction

Brand represents value and commitment. The formation of brand culture is very important for the long-term development of a brand. In the process of management, many international pharmaceutical enterprises take the establishment of enterprise culture and long-term trust of consumers as a long-term and important work, and gradually make this culture deeply rooted in the hearts of the people. However, some pharmaceutical enterprises in China lack planning in the creation of business ideas and values and often sacrifice the long-term interests for immediate interests. Meng and Guo (2012) hold that this short-sighted behavior swallows up the basic integrity of the promise of the pharmaceutical brand and could not establish a pharmaceutical brand culture in the long run.

### **2.3.3 Comparative analysis of the status quo of global and Chinese pharmaceutical enterprises**

At present, the global pharmaceutical industry presents a trend of agglomeration, mainly concentrated in developed countries such as the United States, Europe, and Japan. Compared with developed countries, the annual average growth rate of China's pharmaceutical industry is still in a relatively backward state in terms of pharmaceutical enterprise scale, innovation and brand management. The main factors restricting the development of China's pharmaceutical industry are shortage of funds, weak R&D power, lack of industrialization mechanism, low conversion rate of scientific research achievements and so on.

(1) In terms of growth in the pharmaceutical market

Han (2017) points that in the past decade, the global pharmaceutical market has shown a steady growth trend. For example, the global pharmaceutical market has exceeded \$1 trillion in 2015, with a year-on-year growth rate of 4%. For China, the average growth rate of output value of China's pharmaceutical industry is about 16.6%, which is far higher than the annual average growth rate of World's pharmaceutical industry.

(2) In terms of pharmaceutical innovation

The global pharmaceutical industry attaches great importance to product innovation. The R&D cost of new drugs in pharmaceutical enterprises usually accounts for 15%-20% of their sales revenue. However, the pharmaceutical enterprises in China have low investment in R&D and weak innovation ability. In 2017, the total R&D investment of China's top 100 pharmaceutical enterprises was 31.1 billion yuan, while Novartis Group (2017) invested about 68 billion yuan in R&D in 2017, about twice the total R&D investment of China's top 100 pharmaceutical enterprises.

(3) In terms of enterprise scale

Compared with the international large pharmaceutical enterprises, the scale of pharmaceutical enterprises in China is generally small. The proportion of China's large pharmaceutical enterprises in the total quantity is small, and the concentration of pharmaceutical enterprises is low, so it is difficult to form economies of scale. Generally speaking, China's pharmaceutical enterprises are at the low-side of the international pharmaceutical industry, with high degree of homogeneity of products and outstanding bottlenecks.

(4) In terms of brand management

International large pharmaceutical companies attach great importance to brand management, adhere to and maintain the core value of the brand, and have established a good brand culture management mechanism. There are some problems in brand construction and management of China's pharmaceutical enterprises, including insufficient brand marketing and planning, vague brand recognition, neglect of brand culture construction, and lack of protection of brand patents. In addition, China has not yet formed a brand value evaluation system in the pharmaceutical industry, which has led to a general lack of brand building and management in China's pharmaceutical companies.



## **2.4 The necessity of implementing brand strategy in Chinese pharmaceutical industry**

Due to the shortage of current resources, the rising price of raw materials, the price restriction on policy drugs, the profitability of China's pharmaceutical enterprises drops significantly. These comprehensive factors have gradually highlighted the constraints on the development of China's pharmaceutical enterprises. China's pharmaceutical industry has experienced production competition, quality competition, price competition, service competition, and began to enter the era of brand competition. In order to survive in the increasingly fierce market competition, enterprises must strive to implement brand strategy and build their own brand. Implementing brand strategy not only helps to carry forward the Chinese medicine culture, but also helps to inherit and integrate the culture, thus promoting the further innovation of Chinese medicine products.

(1) Brand is the main driving force of consumers to buy medicine.

Medicine's efficacy and safety are the focus of consumers' attention, but consumers do not have the ability to distinguish the quality of medicine, so they turn their attention to the brand. In a market with many similar varieties, the brand image become the main criterion for consumers purchase or not. This is particularly evident in the OTC market, where consumers are increasingly influenced by product brands, mainly in the OTC category. Brand is the basis for pharmaceutical enterprises to spread product-related information, and is the main basis for consumers to choose products.

(2) Brand can influence consumers' attitudes and behaviors.

As consumers become increasingly concerned about health, they are willing to learn more about diseases and medicines. Consumers' understanding of brand is based on brand cognition, and successful brand management can strengthen consumer's cognition of brand-name medicine. Once the belief that the brand can meet their needs is formed in the minds of consumers, this belief can support them to continue to buy the brand's products. Deng (2010) thinks that strong brands can maintain customer loyalty and generate more predictable cash flow through loyal consumers.

(3) Brand is the core competitiveness of pharmaceutical enterprises.

The Brand strategy of pharmaceutical enterprises is a complex, long-term, systematic project. Strong brand can provide a significantly differential competitive advantage, which is

extremely difficult for competitors to imitate. When a large number of homogeneous products appear in the market, only products with the characteristics of brand differentiation can remain invincible in the market full of homogeneous products. Brands with wide-ranging consumers can create value for all of their customers in a low-cost way and ensure consistent customer satisfaction.

(4) Brand can enhance the international competitiveness of pharmaceutical enterprises.

In the era of brand economy, strong brands can cross the limits of national and market boundaries. Shao (2014) contends, with the development of economic integration, if China's pharmaceutical enterprises want to achieve long-term and stable development, they should occupy both domestic and international markets. The promotion and consolidation of brand strategy of pharmaceutical enterprises can lay a solid foundation for Chinese pharmaceutical enterprises to establish themselves in the international market.

(5) Brand can create a good environment for the listing of new drugs in pharmaceutical enterprises.

The fierce market competition makes every pharmaceutical enterprise invest in the R&D of new drugs, but the listing of new drugs is a difficult problem for every pharmaceutical enterprise. Zhao (2017) concludes that in the pharmaceutical industry, with the expansion of the OTC drug market, it becomes more and more attractive to extend the value of a drug brand in this new market. Brand management can strengthen the attractiveness of its products to consumers, make use of the credibility of the original drug brand to shift consumers' attention to new drugs, and then make the listing of new drugs easier.

## **2.5 Ways to shape the brand of Chinese pharmaceutical enterprises**

In general, Chinese pharmaceutical enterprises must focus on the "irreplaceability" of brand, constantly carry out technological innovation, institutional innovation, cultural innovation, and bring up their own unique and enduring brand. Only by implementing the corresponding brand building and management strategy, can Chinese pharmaceutical enterprises obtain stronger competitive strength.

(1) Optimizing the policy environment for brand growth

The long-term development of the brand cannot be separated from the support of the national policy. China's pharmaceutical enterprises are generally small in scale, backward in equipment and low in technology, which ultimately leads to a low level of drug sales. At the

same time, there are some loopholes in China's medical institutions, for example, the person in charge of medicine becomes the agent of medicine consumption, which makes medicine sales win the market no longer by shaping drug brand, but by means of red envelopes, returns and so on. In order to change this situation, the relevant functional departments of China should intensify the reform of the health system, implement separate management of hospital and medicine as soon as possible, eliminate the agency role of hospital in drug consumption, and realize a fair drug marketing environment. Finally, China should form a good atmosphere for pharmaceutical enterprises to compete for the world by brand.

(2) Quality and technological innovation endows the brand with the characteristics of the times.

Quality and technological innovation are the life of brand building. Without high-quality products, the life of an enterprise brand is not sustainable. Medicine is a special commodity, which is related to the life and health of people. The quality of medicine enterprises must be combined with the modernization of medicine. The implementation of brand building requires the pharmaceutical enterprises to take the lead in quality control and technological innovation. Only with the continuous technological innovation of core products, can pharmaceutical enterprises promote the continuous promotion of brand value, maintain the attractiveness of the brand, and thus adapt to the ever-changing demand of consumers.

(3) Changing the concept of management and correctly understanding and building brand value

At present, most pharmaceutical enterprises in China are medium and small enterprises. If they want to be large and strong, and have stable sales and profits, they must correctly understand the role of brand. Brand is a basis for consumers to identify enterprises and products, a competitive means for enterprises to create sustainable, stable and unique intangible assets and a carrier of enterprises' competitive advantage. For pharmaceutical enterprises, their ideas and management concepts should be innovated constantly: Effective innovation incentive mechanism should be established to encourage all staff to innovate; perfect enterprise brand marketing management system should be established; and the relationship between R&D department and sales department should be strengthened to build an efficient and innovative management system so as to form the unique culture of innovation.

(4) Establish a scientific and reasonable brand valuation system

The process of brand building, development and management is the process of establishing, consolidating and developing relationships with specific consumers. Li (2009) considers that brand building is a systematic engineering, and scientific brand planning requires systematic analysis, namely consumer analysis, competitor analysis and self-analysis. Consumer analysis includes the analysis of consumers' demand and motivation for medicines, and the tapping of potential needs that consumers have not yet met. Competitor analysis includes the study of competitors' strengths and weaknesses, and it is also very important to analyze how consumers view competitive brands. Self-analysis includes a clear understanding of the market position of self-brand, and a clear understanding of how consumers view self-brand, such as corporate culture, product efficacy, and so on.

As Huang (2018) said, at present, the impact of brand value evaluation results of Chinese pharmaceutical enterprises is insufficient, the degree of market recognition is not high, and the market demand is not open. Due to a series of reasons, such as late start, insufficient experience and lack of universally recognized practice standards, the necessity of brand value evaluation of Chinese pharmaceutical enterprises is particularly prominent.

## **2.6 Research questions**

Pharmaceutical brands are important intangible assets and core competitiveness of pharmaceutical companies. Many pharmaceutical brands on the market today have experienced glory, but with the passage of time, many of them are now almost gone. A large number of successful cases prove that to maintain the vitality of a brand, we must take a long-term perspective on brand building, pay attention to product quality, define the market positioning of products, and strive to enhance the brand value (Feng & Liu, 2015).

What are the factors of brand equity or brand value?

Aaker (1996) believes that brand equity consists of five aspects: brand loyalty, brand awareness, quality perception, brand association, and proprietary assets of other brands.

Krishnan (1996) showed interest in brand equity first from brand valuation. For instance, the most interesting part in corporate mergers is the valuation of brand equity and the approaches used by enterprises and researchers to evaluate brand equity.

Keller (2001) proposed the four factors of brand value, including brand recognition, brand connotation, brand reflection and brand relationship, and stressed that there are logically sequential relationships among the four factors.

Mitchell Birkin, CEO of Interbrand of the UK, pointed out that brand value, like other similar economic assets, is the present value of all future earnings and is composed of two important indicators: brand income and brand strength.

How to build a more persuasive and credible value evaluation system for China pharmaceutical companies? How to build a scientific and applicable brand value evaluation model for China pharmaceutical companies?

If this research can build a set of theoretical models and indicator system for brand valuation of pharmaceutical companies in China with scientific and normative approaches, it will have important theoretical and practical significance to implement the brand strategic management of pharmaceutical companies in China, strengthen brand value awareness of pharmaceutical companies, improve service level and capacity, enhance core competitiveness of enterprises, protect the intangible assets, and ensure sustainable development of pharmaceutical companies in China.

## **2.7 Brief summary**

This chapter mainly introduces the research background of this study. Firstly, the general situation of Chinese pharmaceutical enterprises is introduced; secondly, the market environment of Chinese pharmaceutical enterprises is analyzed, including the political, economic, social and technological environment faced by Chinese pharmaceutical enterprises; Next, it also analyzes the status quo of the global and Chinese pharmaceutical industry in detail, and compares and analyzes the necessity of implementing a brand strategy for Chinese pharmaceutical companies. Finally, the way of shaping the brand of Chinese pharmaceutical enterprises is analyzed, and the research questions in this study are put forward.

## **Chapter 3: Literature Review**

In this chapter, it will introduce the literature review related to this study. It is mainly divided into three parts: theories of Brand, theories of brand value and brand value evaluation method respectively.

### **3.1 Theories of brand**

#### **3.1.1 Definition of brand**

In the Oxford Dictionary, brand is interpreted as “to prove ownership, and as indication of quality or other usages”. It is used to distinguish and prove quality. Zhou (2010) shows with the tremendous improvement of social productivity, brand usage has become more and more popular. In the early 19<sup>th</sup> century, the first Trademark Law came into being with a purpose to protect brands. Since then, brands have achieved unprecedented development, such as the emergence of a number of Swiss watch brands, which last long until today (Shi, 2013). The connotation of brand is very abundant. Many scholars around the world have become increasingly interested in branding try to expound the concept of brand from different perspectives, which can be roughly divided into the following categories (Balmer, 2001; Cooper, Merrilees, & Miller, 2015; Rindell, Fernando, & Lima, 2015).

##### **(1) Symbolic theory**

According to the definition by American Marketing Association (1995), brand is a name, term, mark, symbol, pattern, or the combination of these factors that can be used to identify a seller's product or service to distinguish it from the competitor's product. Therefore, the basic characteristics of a brand include two aspects: first, the symbol or mark; second, the product or service of brand is significantly different from those of competitors. The part of the brand that can be expressed in the language becomes the brand name, the part that can be identified but cannot be expressed in words becomes the brand mark, including pattern, symbol or specially designed colors, fonts, and so on. Bian and Forsythe (2012) maintain that consumers use brand names to build their social relationships. Lv (2007) believes that a brand is a name or symbol used intentionally by sellers to distinguish between their product or service and

their competitors, as well as the tangible or intangible characteristics associated with it. It is a reflection of the interaction between the product or service provider and the demander. It not only symbolizes the product value, characteristics, image and supplier's efforts, but also embodies the consumer needs, interests, feelings, personality and values.

#### (2) Relationship theory

Ogilvy (2003) believes that brand is an intricate symbol and is the intangible sum of brand attributes, name, packaging, price, history, reputation, and advertising methods. The brand is also an impression left by consumers using the product. Yu (2002) points that Michael Perry, the chairman of Unilever, believes that brand is how consumers perceive a product. It represents the sum of the trust, relevance and significance generated by consumers' perceptions of products and services in daily life. This type of definition directly combines consumers and brands to affirm consumer's great effect on brands, while at the same time characterizing the brand as a "relationship".

Hu (2013) believes that a brand refers not only a product itself, a registered logo or trademark, but an integrated body of factors including brand attribute, product, symbol system, consumer group, consumer association, meaning of consumption, personality, channel characteristics, price system, and communication system. This ensemble originates from the identification of products, and is an integrated body of consumer world that is recognized by various interest parties who can co-exist harmoniously.

#### (3) Assets theory

Fan (2010) mentions that brands will infiltrate people's hearts and at the same time form indelible intangible assets. The proper usage of brand assets can bring infinite wealth to enterprises. Iglesias, Ind, and Alfaro (2013) believes that brand equity is a value that can far exceed all tangible assets, and it can be expected that future revenue will far exceed the expansion costs required to launch other brands. In short, Liu (2007) considers that the "asset theory" regards brand as an intangible asset and the core part of total brand assets.

Chernatony (2001) explains that a successful brand is an identifiable product, service, people or place that can in some way increases its meaning, making the buyer or user aware of relevant, unique, and sustainable added value that is most likely to satisfy their needs.

#### (4) Six meanings theory

Lefebvre (2011) contends that in terms of function, the brand refers to a product that provides consumers with functional benefits and added value that they think is worth buying,

and can bring added value and benefits to enterprise (to generate value-added symbols); and in terms of connotation, the brand is the consumer's recognition and trust in the enterprise and its products and services.

The famous marketing guru Kotler (2001) argues that brand is a name, term, mark, symbol or design, or a combination of them. The purpose is to enable customers to identify the products and services offered by a certain provider or a group of providers and distinguish them from those of the competitors. He believes that brand is a long-term promise of a specific set of characteristics, benefits and services offered by the seller to the purchaser. At the same time, brand is still a more complex symbol. It can express six meanings of attributes, benefits, value, culture, personality, and users.

- ① Attributes: Brands first remind people of certain attributes.
- ② Benefits: Attributes need to be translated into functional and emotional benefits.
- ③ Value: Brands also reflect some values of the manufacturer.
- ④ Culture: Brands also represent a certain culture.
- ⑤ Personality: Brands also reflect the users' personality.
- ⑥ Users: Brands imply the type of consumers who use or purchases the product.

Based on the above definition of brand, we can understand the connotation of brand from two aspects:

For enterprises, brand is a tool to identify products and services and to distinguish them from those of the competitors. Successful corporate brands are sought after by customers and other stake-holders alike. At the same time, brand is also an asset. Well-operated brands can help enterprises obtain excess profits through certain ways.

For consumers, brand represents attributes and benefits. As Balmer (2012) said, corporate branding aficionados appreciate that successful corporate brands imbue institutions with considerable leverage because of the positive assurances that are linked to the company name. Once a brand is well-known to consumers, it will generate psychological benefits such as safety and trust, simplify the consumer's purchase decision-making process, and then provide the enterprise with sustained excess returns (Aaker & Fournier, 1995).

Through the definition of brand by different scholars, it can be seen that brand is valuable, and the source of value is the consumer's subjective feelings about the brand. Brand gives consumers some benefits in terms of utility and emotion, enabling consumers to



establish a good relationship with enterprises, which is why the brand has added value.

### **3.1.2 Classification of brands**

According to different classification methods, the following are some common brand classification:

(1) From the perspective of brand object, it can be divided into product brand and enterprise brand (Hu, 2016).

The brand of a product or service in an enterprise is generally called the product brand. The product brand promotes the sale of the product by establishing a certain brand image. Generally, it only serves specific products. When a single product forms a series with the ability to cross the industry, the product brand develops into the enterprise brand. The enterprise brand unifies the differentiated product brands and provides support for each product brand in terms of culture, quality, service and so on. The enterprise brand represents the values, cultural concepts, business philosophy and service attitude of enterprises to the vast number of consumers. Only by establishing a unique and culturally distinctive brand, can an enterprise continuously enhance the value of its brand, thereby enhancing its competitiveness.

(2) From the perspective of brand influence, it can be divided into regional brands, domestic brands and international brands (Liu, 2015).

Regional brands often refer to brands produced and sold in a certain small range. These products have specific consumer groups and are limited by geographical, cultural, and product characteristics. Usually, the marketing scope of regional brands is small. Domestic brands refer to brands which are well-known and are in demand all over the country. The products of domestic brands are available throughout the country. International brands refer to brands with high popularity and reputation in the international market, which are favored by people all over the world. The marketing of products of international brands is almost unaffected by external factors.

(3) From the perspective of the brand life cycle, it is divided into short-term brands and long-term brands (Zhang, 2018).

Short-term brands refer to brands with short-term life cycle, which generally lose their continuity ability after a short period of existence. Long-term brands refer to brands that can adapt to market changes and have a certain market position, such as Coca-Cola, Benz and so

on.

(4) From the perspective of brand performance, it can be divided into strong brand and weak brand ( Jin, Zhang, Cao, Gu, Wei, Xie, et al., 2018).

Strong brands usually lead the market and are the vane of market dynamics. Weak brands are relatively weak in terms of market share, excess returns, risks resistance, and product upgrading.

### **3.1.3 Characteristics of brand**

(1) Brand is figurative.

Zhang (2016) points that as an intangible asset of an enterprise, brand must be reflected through material carrier. This material carrier may be a name, mark, symbol, design or its combination. Without carrier, brand cannot be embodied.

(2) Profound cultural connotation

As a collection of special cultural significance, brand endows products with cultural value and concentrates various information symbols transmitted by enterprises. Therefore, personalized brand culture is the soul of the existence of brand. Liu (2012) thinks that it is through brand cultural power that brand influences the customers' psychology, thereby gaining consumers' identity, and ultimately achieving the goal of improving brand popularity.

(3) Intangible value

Once the brand has been successfully built, it will have tremendous added value and bring huge economic asset benefits. Due to its own unique popularity, reputation and other factors, the intrinsic value of the brand has far exceeded many tangible assets, and become the most valuable intangible assets of enterprises that exists independently of products and can be traded (Qu, 2018).

(4) Brand is malleable.

Enterprises can exploit new markets by making use of the popularity of existing brands and constantly develop and expand their own customer groups. This includes two levels: One is the extension of space. An excellent local brand can seek a broader market while basing itself on the local market. For example, Sinopharm Group has a share in the international market through its international strategy. The other is the extension of the product line. Gao (2017) believes that when an enterprise launches a product that is different from its existing product with a successful brand, it can greatly reduce marketing expenses.

#### (5) Unique quality assurance

Brand belongs to the definition of intellectual property. While enjoying its unique rights, brand must take values, interests and characteristics as the foundation to provide consumers with a commitment to achieve long-term trust and preference. Yi (2017) holds that when a consumer buys a certain brand, this trading relationship contains the quality commitment of brand. Once consumers accept the brand, they actually accept the promise that comes with the brand.

### **3.1.4 Brand management**

Brand management refers to the comprehensive use of enterprise resources to achieve the strategic objectives of brand management of products and services through planning, organization, implementation, control and other ways. Brand management includes brand establishment, brand promotion, brand extension, brand maintenance and so on. Li (2013) believes, through this organic management of the whole process, not only can the brand play a good driving role in the overall operation of the enterprise, constantly enhance brand awareness, and improve customer's loyalty to products, but also can promote the sale of products and service, and ultimately translate into sustainable economic benefits.

In a series of contents of brand management, brand value is the core part of brand management, and it is also an important condition for the brand to distinguish itself from similar brands. The target of brand management is to establish the core value of the brand, and to enhance, improve, implement and publicize this core value in all future business activities, and engrave it into the minds of consumers. Only when these core values are deeply imprinted in the minds of consumers and form brand loyalty, will the brand have the appeal of consumption and become well-known.

## **3.2 Theories of brand value**

### **3.2.1 Connotation of brand value**

According to Barth, Clement, and Kasznik (1998), the brand value of an enterprise is the market price of the future development and profitability of the company as reflected in the evaluation and expectation of a company's overall strength and reputation by long-time

experience and comparison of consumers during the fierce competition in the market. Brand value has relation to the equity value of the company. Brand value is the core benefit brought to consumers by the brand. It allows consumers to identify and remember the brand clearly and is also the main force that drives consumers to identify, like and even chase a brand (Bao, Liu, & Wang, 2009).

Farquhar (1989) contends that the brand value is the additional or added value that the brand brings to the product, and the benefit or value exceeds its use value. Shocker and A (1988) explores brand value from three perspectives of enterprises, channels, and consumers. They believe that brand value comes from the difference between the cash flow of branded products and unbranded products. Brand value is the value that makes it easier for enterprises to enter the market. It is the product name that increases or decreases value in the minds of consumers. At the same time, they point out that internal corporate management, brand leverage, and market management are important factors influencing brand value. Aaker (1991) defines the brand value as a series of liabilities or assets related to the brand, brand identity and brand name. Through the product or service, the value of enterprises or customers can be increased or decreased. He divides brand value into five dimensions of brand association, brand recognition, brand loyalty, brand awareness and other proprietary brand assets, which are used as the basis for measuring brand value. Keller (2003) points out that consumers will generate brand associations and imaginations in brand marketing activities, and this particular association will lead consumers to make different consumer behaviors, and brand value also exists in the link between brand and product in the minds of consumers. The specific perceptions and emotions of a certain brand in the consumer's subconscious mind will guide the consumer's consumption behavior and bring value to the brand holder. Kim and Kim (2005) believes that brand value consists of three parts: cost value, relationship value, and rights value. Each component has two sources, namely, the corporate source and the consumer source. Ai (1997) argues that brand value is the intrinsic value of the brand, the overall evaluation of the "third state assets" represented by the brand, and quantification of the whole assets with extraordinary profit-making ability in the actual economic activities. The intrinsic value of the brand exists objectively and is determined by the entire assets of the company and its operating conditions.

Zhang (2000) argues the essence of brand value is brand rights, which are the organic unity of legal rights and market rights. The size of brand value mainly depends on market rights of the brand, and the brand rights are entrusted by consumers. Liu, Yang, and Xu (2005)

believe that brand value is a comprehensive value combining financial value and non-financial value, which reflect the values of brand owners and users in the brand value system respectively. Wang and Li (2005) contend that the value of brand lies not only in the brand owner's investment in daily operations, but also in the extent to which consumers recognize and favor the brand and the degree of consumers' repeated purchases and loyalty of products and services with certain brands. The more compatible the two aspects, the greater the value of the brand are. Zhao and Gu (2011) expound the significance of enterprise brand evaluation, and propose a brand value evaluation method based on fuzzy theory. That is, through the combination of fuzzy mathematics theory and Delphi expert scoring method, the evaluation model of enterprise brand grade is established.

### **3.2.2 Formation mechanism of brand value**

To evaluate brand value accurately, it is necessary to have a deep insight into the forming process of brand value. In the related research on the forming process of brand value, “brand value chain” model proposed by Keller in 2003 and “brand action mechanism” model proposed by the Chinese scholar Fan Xiucheng in 2000 have certain representativeness.

#### **(1) Brand value chain model**

According to this model, brand value first arises from the customer's perception of the brand, which in turn affects the brand performance in the market, and ultimately influences the financial market. The model expresses the forming process of brand value in a comprehensive, integrated approach. As shown in Figure 10 in Appendix 1.

The source of brand value is the consumer's perception of the brand. The marketing activities of enterprises should first have an impact on the consumer's psychological cognition and establish the consumer's brand knowledge structure, such as brand awareness and brand association. For enterprises, consumers' perception of the brand is not the end of brand management. The accumulated brand knowledge of consumers must be reflected by the market performance of the product to which the brand belongs, such as price elasticity, repeated purchase behavior, market share, and sales revenue and so on. With the increasing maturity of financial markets, the market performance of the product will undoubtedly be reflected in the valuation of stock market or the transaction prices of the merger and acquisition.

Therefore, the internal logic of brand value is: consumers' psychological cognition → market performance of brand → financial market reaction of brand. From the forming

process of brand value, brand brings financial value to enterprises through its influence on consumers' psychology and behavior. Grau and Folse (2007) say that in many cases, consumers make purchase decisions dependent not only on the product itself, but on consumers' preference for the brand. Therefore, consumer factors should be taken into account in the evaluation of brand value.

## (2) Brand action mechanism model

According to Consumers Behavior Theory, the purchasing process of consumers is a process of information gathering, comparison and selection. Under the premise of definite demand, consumers will actively mobilize the information stored in their minds and collect new information to compare the advantages and disadvantages of different products within a certain product range. Margareta and Jana (2018) believe that a brand is the best way to distinguish products. Excellent brands tend to be the priority for customers.

Based on consumer behavior theory, Fan (2000) proposed the brand action mechanism model. The basic logic of this model is that brand value refers to the future incremental income that the brand brings to the enterprise, which depends on the customers' future purchasing intention and purchasing behavior. The customers' purchasing intention and purchasing behavior depend on the influence of the brand generated by the enterprises' previous marketing efforts on the customers' psychology. As shown in Figure 11 in Appendix 1.

Through effective brand marketing strategy, enterprises can influence consumers to a certain extent, so that consumers can make changes psychologically and behaviorally beneficial to enterprises. If the brand has a high reputation, good quality, and has obvious differences compared with other competitive brands, then the brand will easily attract the customers' attention, and become the priority for consumers when purchasing.

### **3.2.3 The characteristics of brand value**

Opinions vary among different scholars on the concept of brand value and its source, which causes people to have different opinions on the factors constituting brand value. Therefore, Tang, Qu, and Sun (2013) contend that the studies on the factors of brand value present a multi-perspective and multi-dimension feature. Generally speaking, brand value has the following characteristics:

#### (1) Brand value has objectivity.

Brand value exists objectively in the brand. When consumers prefer a product in the market for similar products, and are willing to pay more than the value of the product itself, that is because of the existence of brand value.

(2) Brand value is difficult to measure accurately.

Many factors should be considered in evaluating brand value. At the same time, the potential cash flow brought by brand to enterprises has strong uncertainty, which further increases the difficulty of accurate evaluation. So Neal and Strauss (2009) maintain that we must choose optional and valid way to measure it.

(3) Brand value has fluctuation.

The fluctuation of brand value means that the brand value does not remain unchanged, but changes with the internal management and external market conditions. Liu (2017) maintains that when the brand has a good momentum of development and consumer have a high preference for the brand's products, it means that the brand value is high; when the market is sluggish and the business capacity of the enterprise declines, it means that the brand value will also decline. The fluctuation of brand value is mainly affected by four factors, as shown in Figure 12 in Appendix 1.

### **3.3 Brand value evaluation methods**

Dai and Yuan (2017) argue that brand valuation is an important part of brand management. How to value different types of brands efficiently and accurately is an important area of concern for brand managers. Brand value evaluation is a complex process. To scientifically evaluate brand value, it is necessary to construct a scientific evaluation index system. At present, scholars at home and abroad have constructed various brand evaluation models from different perspectives. From the perspective of assessment, brand value assessment methods can be divided into financial-factors-based assessment methods, market-based assessment methods, and consumer-based assessment methods (Ailawadi, Lehmann, & Neslin, 2003).

#### **3.3.1 Financial-factors-based assessment methods**

Recognizing brand value based on financial factors is the earliest method used to evaluate brand value. The advantage of the financial-factors-based assessment methods is that monetization of brand assets can better explain the business performance of the enterprise,

facilitate the explanation of the operation status to stakeholders, and facilitate the enterprise to formulate strategies such as mergers and acquisitions, financing and other strategies. The methods used at this stage are mainly cost method, stock value method and income method.

#### (1) Cost method

Gong, Yu, Li, Du, and Shen (2009) point out, the cost method is to assess the brand value from the perspective of brand creation costs which include a series of costs such as design and development cost, promotion costs, and trademark protection costs. The cost method is divided into historical cost method and replacement cost method.

##### ① Historical cost method

The historical cost method uses the pricing theory in financial accounting and considers the brand value as the cash equivalent spent on the target brand based on the valuation of the cost of purchasing the foreign brand or creating the self-owned brand. The various costs of a brand are calculated such as development and research, distribution agreement, advertising design, and trademark patents. You (2017) believes, this method of calculation can reflect the process of brand value formation and clarify the proportion of various types of assets, with each account generated by the brand clearly on the record.

However, the historical cost method has certain limitations. Song (2017) contend, for the time-honored brand, it is difficult to obtain its early financial data, and the concept of “brand building expenditure” is ambiguous and difficult to define accurately. It is difficult to identify whether the expenditure is for brand development or the overall development of the enterprise, or to separate the expenditure of brand service from the expenditure of enterprise service.

##### ② Replacement cost method

The replacement cost method is a method to determine the brand value by supposing that you want to create a brand with the same function as the target brand, evaluate and estimate the required creation cost, and then subtract the loss or devaluation. Chen (2017) believe that the replacement cost method takes the evaluation object as the criterion, and needs to calculate the total investment cost needed to replace the existing target of evaluation with a new brand of similar influence. This method also has its limitations.

Since the brand is influenced by many factors in its development, it is difficult to find a very similar brand under the actual market conditions. In addition, to use the replacement cost method to assess the overall assets, it is necessary to turn the overall assets to zero into several single assets, and determine the replacement cost, the devaluation by real degradation and the



devaluation by intangible degradation. Therefore, Fu (2016) considers this method is time-consuming, and repetitions and omissions sometimes occur. As a result, the feasibility of replacement cost method in evaluation practice is greatly limited.

### (2) Stock value method

The stock value method was proposed by Simon and Sullivan (1993) of the University of Chicago. The basic idea of this method is to take the stock market value of listed companies as the basis, strip the tangible assets off from the total assets, and then separate brand assets from intangible assets. But the stock value method is only applicable to listed companies. This method is mainly applicable to the brand equity evaluation of listed companies in the mature market. Under the current stock market environment in China, the value deviates from the market value seriously, so this method is not suitable.

### (3) Income method

The income method is a method of brand valuation based on the future earnings of the brand. Li (2014) points out, it first estimates the future income brought by the brand, and then uses a reasonable discount rate to convert the future income into the present value of income, and finally add up the present value of these earnings to calculate the brand value. The variables in this assessment method mainly include expected income period, expected income, and discount rate. In theory, this method is more scientific and reasonable in brand valuation.

When the income method is used to evaluate brand equity, we also need to differentiate the contribution rate of brand equity and other assets to the expected future earnings of enterprises respectively. The basic formula is as follows:

$$V = \sum_{t=1}^n \frac{K \times R_t}{(1+r)^t} \quad (3.1)$$

V: the evaluation value of brand equity

t: the nth year

K: the contribution rate of brand assets

R<sub>t</sub>: the income of the t-year

R: the discount rate.

The income method focuses on the excess income that brand equity brings to the enterprise in the future. To a certain extent, it can reflect the value of brand equity. The authoritative Interbrand evaluation method is based on the income method, but there are some difficulties in the actual practice:

First of all, the forecast of the expected income of the enterprise in the future is greatly influenced by the subjective judgment of evaluators, so it is difficult to judge the discount rate and the brand life. Secondly, brand equity cannot bring cash flow to the enterprise alone; it must be combined with other tangible assets to create profits, so the measurement of the contribution rate of brand equity is also a difficult problem. Finally, the value of brand equity largely depends on consumers' recognition, while the income method does not take consumer factors into account at all.

In a word, there are certain deficiencies in financial-based assessment methods as there is no clear internal operation mechanism of brand assets. The brand value under this assessment method has no real value for corporate brand management.

### **3.3.2 Market-factors-based assessment methods**

Pitta and Katsanis (1995) believes that the financial approach is only important when considering brand acquisitions or mergers. Financial value should only be the second objective on brand valuation, while it is more important to focus on the future growth. Michael (1994) persists that a vital factor in determining the value of a brand is its potential profitability in the future, so the size of the brand assets should be reflected in the brand's own capabilities of growth and expansion, such as brand extension capability. The market-factors-based assessment methods are proposed in response to the continuous expansion and growth of the brand. In the understanding of brand value based on market factors, market factors are involved in addition to financial factors so that the assessment results reflect the market position of the brand and can provide managers with specific management guidance.

The biggest difference between the market-factors-based model and the financial-factor-based model is that the financial conceptual model focuses on the short-term benefits of the brand, while the market-based brand conceptual model focuses on the long-term development potential of the brand. At present, Interbrand model and Financial World model belong to this type of assessment method.

#### **(1) The interbrand model**

In the 1990s, the Interbrand Brand Group of Britain developed the famous Interbrand model and designed a formula to measure the value of the brand. The basic standpoint of the evaluation method of the Interbrand model is the market, which is essentially a variant of the income method. The core indicator of the assessment is the brand's future earnings. Fu (1999)

contains the basic assumption of this model is that the reason why a brand has value is not solely because of the cost in creating a brand, nor the higher premium of a branded product than a non-branded product, but the fact that brand can bring its owner stable earnings in the future.

According to Interbrand, the evaluation of brand value must not only take into account the impact of the brand on the economic value added (EVA) of the company, but also prospective future earnings created by the brand for long-term corporate operation. The two research steps are analysis of role of brand and analysis of brand strength score. The former is reflected in the degree of influence of brand on corporate business, or the degree of influence on the customer purchase decision; the latter is reflected in the impact of the corporate management brand on the company's future business income risk, and it is a long-term prediction of the company's future brand income. Interbrand Valuation Mode is shown in Figure 3-1.

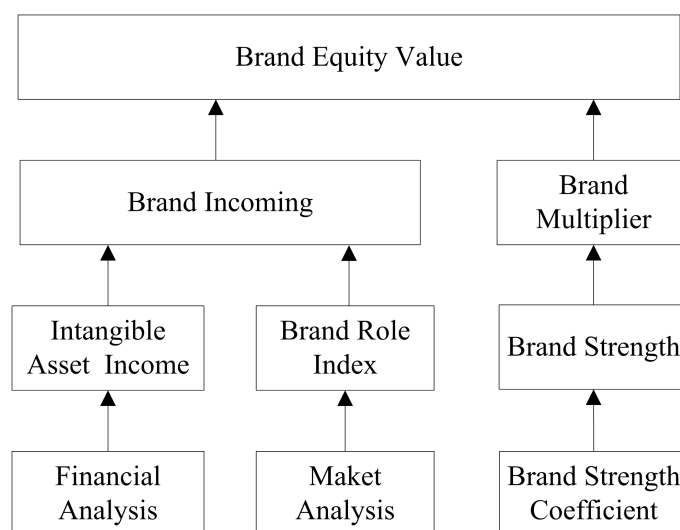


Figure 3-1 Interbrand valuation model

The Interbrand model is mainly composed of two indicators: brand income and brand multiplier. The brand valuation method of Interbrand mainly includes the following steps:

① Determine the brand income

Firstly, determine the income of the enterprise through the financial statements of the enterprise. Then, separate the income created by the intangible assets from the enterprise income. Finally, since intangible assets include brand, management level, marketing ability, technology and other intangible assets, it is necessary to determine the contribution rate of brand, which is represented by the brand role index. Brand income is calculated as follows:

Brand income=intangible assets income×brand role index

Intangible assets income=business profit–tangible assets profit

Business profit=sales revenue–costs–period expenses–taxes and surcharges

In practice, Interbrand model generally uses the weighted average after-tax net profit of the brand in the past three years is generally used as the forecast value.

## ② Determine brand strength

The basis for determining brand strength is to identify 80-100 parameters from 7 categories parameters that affect the brand value and score them. The Interbrand model specifies a maximum score of 100 points for each parameter. The brand strength is then calculated based on the weighting of score and weight of each parameter. Because the future earnings of a brand are based on the prediction of its recent and past performance and possible changes in future, the stronger the brand is, the easier it is to achieve its expected return. The composition and weight of brand strength factor in Interbrand model is shown in Table 3-1.

Table 3-1 Composition and weight of brand strength factor in interbrand brand valuation model

Evaluation Factors	Explanation	Weight
Leadership	Market positioning of the brand	25%
Stability	The ability of the brand to safeguard consumer privilege	15%
Market	Market growth and stability of the brand	10%
Internationality	The ability to transcend national geographic and cultural border	25%
Trend	Influence of the brand on industrial development direction	10%
Support	Continuous investment and key supporting degree of the brand	10%
Protection	Legitimacy and protection degree of the brand	5%

Leadership reflects the market positioning of the brand. The strong brand has the ability to occupy a huge market share and become the dominant force, such as determining prices, controlling distribution, and resisting the intrusion of foreign competitors.

Stability is the embodiment of brand viability in the industry. The brand with strong stability has strong survivability.

Market actually reflects the market environment in which the brand is located. Such as market potential, barriers to entry, and the growth of the market in which the brand is located.

Internationality refers to the ability of a brand to cross international boundaries and become an international brand.

Trend means the influence of the brand on industrial development direction. Specifically, the brand that can keep up with the times to meet consumers' demand has a high trend.

Support reflects the continuous investment and key supporting degree of the brand. The more support the brand gets in technology, finance, policy and other aspects, the higher the score is.

Protection reflects the legitimacy and protection degree of the brand. The more kinds of intellectual property right a brand owns, the better it can resist brand infringement and enhance the brand's market power.

③ Calculate the brand strength multiple according to brand strength

The most critical parameter in Interbrand brand value evaluation method is brand strength multiple, which are usually between 6 and 20 times, indicating the years that a brand may be profitable. Interbrand created an “S-curve”, through which the brand strength score is converted into strength multiple. As shown in Figure 3-2.

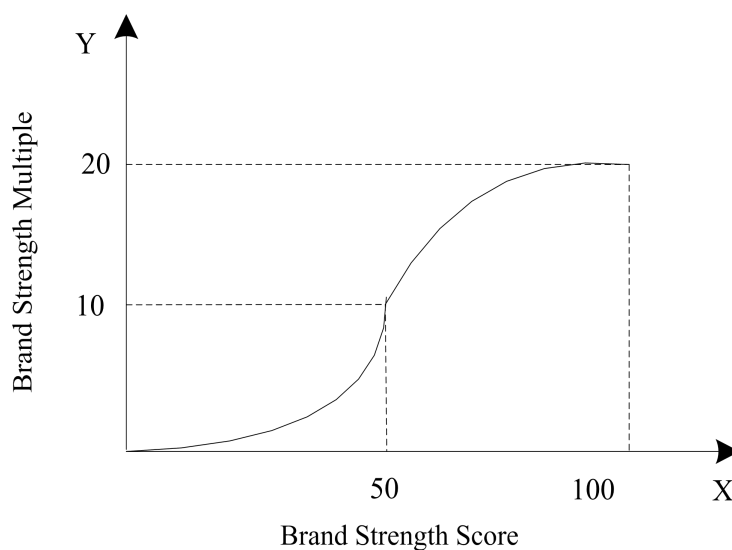


Figure 3-2 Brand strength s-curve

The formula of brand strength multiple and brand strength score is as follows:

$$\begin{cases} 250y=x^2, & x \in [0,50] \\ (y-10)^2=2x-100, & x \in (50,100] \end{cases} \quad (3.2)$$

④ Calculate brand value

In fact, S-curve converts the actual brand strength score into the discount rate applicable

to the future earnings of the brand. According to the Interbrand model, there is a certain relationship between the discount rate and the brand strength multiple, which are reciprocal to each other.

$$i = 1/S \tag{3.3}$$

I is discount rate, S is the brand multiplier

The value of brand equity can be obtained by discounting the expected earnings of brand equity:

$$V=P/i \tag{3.4}$$

V is brand value, P is brand incoming, i is discount rate

According to formulas 3.2 and 3.3, multiply brand strength multiple by brand earnings to achieve brand value.

$$V=P*S \tag{3.5}$$

V is brand value, P is brand incoming, S is the brand multiplier

The research method used in this study is a modification of the Interbrand model.

## (2) Financial world model

This is the main method used by the U.S. Financial World and it is basically similar to the Interbrand model, but relies more on expert opinions. In estimating data such as the benefits brought by the brand and the average industry profit rate, it is mainly based on expert estimation. The calculation procedures of this model are as Table 3-2:

Table 3-2 Financial world model calculation procedures

No.	Item	Formula
1	Sales	(actual)
2	Profit margin	(industry)
3	Profit amount	(1) × (2)
4	Capital ratio	(industry)
5	Theoretical capital	(1) × (4)
6	General profit	(5) × 5%
7	Brand profit	(3) – (6)
8	Revised profit	weighting for two years
9	Tax rate	(industry)
10	Theoretical tax payment	(8) × (9)

11	Net profit	(8) – (10)
12	Brand Strength multiple	S-curve
13	Brand value	(11) × (12)

First, estimate the average industry profit rate and sales, and, in turn, calculate the company's operating profit.

Second, exclude the profits brought by non-brand factors from operating profits. In this process, experts need to estimate return on assets to calculate the amount of profits generated by the brand.

Third, obtain the brand strength according to the brand strength seven factors of the Interbrand model. Use the S-curve to convert the brand strength to the brand strength multiple ranging from 6 to 20.

Fourth, use the Financial World model to calculate the brand value, that is, multiply brand strength multiple by brand earnings to achieve brand value.

In the Financial World method, the net profit of brand assets is obtained through the subjective judgment of experts, while the Interbrand method is based on the financial data of enterprises. This is the main difference between the Financial World assessment method and the Interbrand assessment method. The calculation method and process of brand strength multiple in Financial World assessment method are exactly the same as Interbrand assessment method. It can be seen that the relatively strong subjectivity of Financial World assessment method makes it more suitable for the evaluation of influential brand assets. The Financial World Model mainly has the following deficiencies:

On the one hand, the brand assessment method adopted in the model does not segment the excess earnings. The evaluation result is not so much the brand value as a package of intangible asset value including the brand. If the value is entirely attributed to the brand, then the brand value is inevitably exaggerated. On the other hand, there is no theoretical basis for or empirical analysis of the brand strength coefficient. It is mainly based on subjective judgments and is difficult to convince people.

### (3) World brand lab (WBL) model

The World Brand Lab, based in New York, was founded in 1999 and has a history of nearly 20 years. In the assessment of brand value, the WBL model believes that the brand value comes from three parts: financial factors, brand value added and brand strength. As the world's leading brand assessment agency, the original assessment method "brand added value"

(BVA) assessment model has been widely recognized by the business and the financial community. The model uses the Economic Value Added Method (EVA) to determine the profit of the company through the comprehensive analysis of the sales revenue, cost, profit and other data. The analysis process of brand value by WBL model is shown in Figure 13 in Appendix 1.

Its mathematical formula is:

$$V=E \times BI \times S \quad (3.6)$$

V is the brand value, E is the corporate earnings, BI is the brand value-added index, and S is the brand strength.

E is the adjusted annual business income. Financial analysis is to analyze the financial data of enterprise in recent years, such as business income, and calculate the annual business income of enterprise by mathematical method.

BI is the brand value-added index, which is obtained by weighting the excess returns of all branded products of the enterprise compared to the excess of the non-branded products. The World Brand Lab develops the "brand value added tools", with an aim to separate the contribution of brand elements to the corporate revenue from the overall revenue through a certain mathematical statistical analysis. The brand value added is expressed in BI, which is similar to the brand role index in the interbrand model. Xu (2016) believes this model uses "BVA Tools" to calculate the contribution of brand to current revenue, which is reflected in the ratio of brand added value to operating income. The basic idea can be expressed by the following formula:

$$BI= \frac{Q_1 \cdot (P_1 - X_1) + Q_2 \cdot (P_2 - X_2) + \dots + Q_n \cdot (P_n - X_n)}{Q_1 \cdot P_1 + Q_2 \cdot P_2 + \dots + Q_n \cdot P_n} \quad (3.7)$$

Q: the sales quantity of brand products

P: the sales price of brand products

X: the sales price of non-branded products

n: the quantity of brand products of enterprise

S is the brand strength coefficient, which is used to convert the brand income into the real value of the brand. The brand strength in this model is similar to that in the Interbrand model, but the amount of indicators increases from seven to eight, including nature of industry, degree of support, brand awareness, brand loyalty, position in industry, development capabilities, management capabilities and stability, which is expressed in Table 4 in Appendix



2.

The above three steps are independent of each other and have no influence on each other. Multiplication of their results leads to the value of brand equity. The risk prediction of future earnings is not comprehensive enough, which is the most obvious disadvantage of the world brand lab method. Interbrand method uses s-curve to connect brand strength with discount rate of future earnings, so as to estimate the risk of discount of future earnings.

#### (4) Beijing famous brand assets assessment method

Based on the actual situation of China, Beijing Famous Brand Asset Assessment Company has established Beijing Famous Brand Assets Assessment Method by referring to the evaluation system of "financial world" theoretically. Wang (2007) mentions, in 1995, Beijing Famous Brand Asset Assessment Company first issued the "China's Most Valuable Brands List", which pioneered the evaluation of Chinese brand value and attracted great attention from the media and society. At present, it has become an important reference for the global business community to understand the market competitiveness of Chinese famous enterprises.

Besides seven strength factors of Interbrand model, this evaluation system considers market share, export ability, value-added profitability, expansion ability, investment support, legal effect of trademarks and other factors. Then these factors are transformed into three evaluation indicators: brand market share (M), brand value-added profitability (S) and brand development potential (D), respectively with the weight of 4, 3, 3 (slightly adjusted in different industries). The assessment method can be expressed by the following formulas:

$$P=M+S+D \quad (3.8)$$

P: the comprehensive value of the brand

M: the brand market share

S: the brand value-added profitability

D: the brand development potential

M is expressed as the ability of the brand to influence the market in the industry, which is mainly reflected by the sales revenue of the product. This model believes that sales revenue can best represent consumers' recognition of the brand.

S means the ability of the brand to exceed the average level of profitability in the industry. Its representative financial indicators are operating profit margin and sales profit margin. However, due to the imperfect production factor market in China, it is difficult to

compare different industries.

D is used to evaluate the development potential of brand in the future, which refers to the concept of brand strength coefficient in the Interbrand model. The factors that influence the development potential of the brand are complex, which involve many factors such as the frequency of consumers' use of product, market influence, market penetration, advertising density, brand stability, the ability to transcend geographical and cultural boundaries and so on.

With the continuous deepening of brand research in China, many scholars have raised the following questions about the fairness of Beijing Famous Brand Asset Assessment Method.

First, this method evaluates the intangible assets completely according to the financial materials provided by the evaluated enterprises, so lacks the "third party" independent financial data information. Second, the assessed enterprises that joins the "Most Valuable Brand Evaluation System" are required to pay a certain amount of handling fee. As a result, some well-known brand enterprises that do not pay the fees are excluded from the "most valuable brand evaluation system". Finally, due to the opacity of the evaluation process and the limitations of specific assessment indicators, as well as the failure to publish the case analysis of "empirical cases", it is questionable whether the most valuable brand in China can be truly evaluated.

### **3.3.3 Consumer-factors-based assessment methods**

In this stage, the brand assessment takes into account the consumer factors, and the assessment is mainly based on consumer perception and feeling of the brand. The assessment results can reflect the real feelings of consumers about the brand. The representative models include the Brand Equity Ten Model, Brand Asset Valuator Model and Brand Equity Engine Model.

#### **(1) Brand equity ten model**

The Brand Equity Ten Model was proposed by American brand expert David Aaker in 1996 with reference to various brand value assessment methods. Aaker regards brand value as a competitive force of the brand, which can measure consumers' demand for the brand products. From the perspective of consumers, the Brand Equity Ten Model believes that the brand value can be measured from ten specific indicators in five aspects, namely, brand loyalty, brand recognition or leadership, brand association or difference assessment, popularity assessment and market behavior assessment. Brand Equity Ten Model is the most

famous and relatively complete assessment model so far (Wu & Chang, 2012). As shown in Table 3-3.

Table 3-3 Brand equity ten model of David Aaker

Brand Value	Ten Specific Indicators	Weight (%)
Brand loyalty	① Premium	10
	② Satisfaction/loyalty	10
Brand recognition or leadership assessment	③ Brand recognition	10
	④ Leadership	10
Brand association or difference assessment	⑤ Value cognition	10
	⑥ Brand personality	10
	⑦ Enterprise association	10
Popularity assessment	⑧ Brand awareness	10
Market behavior assessment	⑨ Market share	10
	⑩ Market price and channel coverage	10

Source: Aaker (1996b)

① Brand loyalty is the core factor of brand assets and reflects consumers' psychological response to brand preference. Since loyalty can be converted into profit flow, brand loyalty is a key factor when evaluating the brand equity from the perspective of consumers. Customer satisfaction and repeat purchase patterns are often signs of a healthy brand.

a. Premium mainly refers to the price that consumers are willing to pay more than those without brands.

b. Satisfaction/loyalty measure how satisfied consumers are with the product, such as whether they will continue to buy the product next time.

② Perceived quality refers to consumers' overall quality perception of a brand. It can reflect consumers' evaluation of products in many aspects, and is also the basis of differentiated positioning of products.

c. Quality Cognition refers to consumers' perception of the quality of the brand compared with other brands.

d. Leadership measures whether a brand is one of the leading brands.

③ Brand association refers to all associations that consumers generate through the brand, which is the basis of brand extension. Usually, brand will associate people with product characteristics, consumer composition, consumer interests and competitors, and specific associative content varies from brand to brand.

e. Value cognition is the differentiated response of existing brand knowledge in customers' minds to brand marketing.

f. Brand personality is the human personality characteristic of brand in consumer cognition.

g. Enterprise association refers to the consumer's perception and understanding of the specific brand connotation, and is all the information nodes associated with the brand in the consumer brand knowledge system.

④ Brand awareness refers to the degree to which brand names are known by consumers. Brand awareness can influence consumers' attitudes towards product. In some cases, it is also the driver of brand choice and brand loyalty.

h. Brand awareness is the ability of a buyer to recognize or remember that a brand is a product.

⑤ Market behavior is the embodiment of brand's ability to control the market.

i. Market share refers to the proportion of sales of branded products in the total sales of similar products, reflecting the position of the enterprise in the market.

j. Market price and channel coverage reflects the product price is in line with the market and the store ratio of the brand.

## (2) CBBE model

In 1993, the famous American professor Keller defined brand value as the differentiated response of existing brand knowledge in customers' minds to brand marketing. This kind of reaction is the result of customers' effect on the existing brand knowledge, which is reflected in the perception and preference related to brand marketing, and ultimately leads to the difference between brand loyalty and brand value. He proposed the “consumer-based brand equity model” (CBBE), which emphasizes that the consumer cognition as well as consumer knowledge, feeling and experience of the brand is the foundation of brand value. In 2001, Professor Keller further proposed the brand resonance model, emphasizing that the construction of brand equity is a top-down and gradual process (Keller, 2001).

According to the brand resonance model, the construction of a strong brand requires four steps: establish the correct brand identity; create the appropriate brand connotation; guide the correct brand response; and build a resonating relationship between consumers and the brand. These four steps are dependent on the six dimensions of brand building: salience,

performance, imagery, judgments, feelings, and resonance. Among them, salience corresponds to brand identity, and performance and imagery correspond to brand connotation, judgments and feelings correspond to brand response and resonance corresponds to brand relationship. Yang, Sonmez, Gonzalez, Liu, and Yoder (2019) considers that CBBE has attracted academic endeavor to examine its role for brand success. The CBBE brand equity assessment model is shown in Figure 14 in Appendix 1.

Fang and Su (2016) agree that although the CBBE model emphasizes the importance of consumers, it ignores the consumer initiative in the formation and accumulation of brand knowledge and ignores the fact that consumers are also co-creators of brand equity. This is a defect in the model itself, and in the Internet era, this defect was amplified into a problem that cannot be ignored in brand building.

### (3) Brand asset valuator model

Brand Asset Valuator (BAV) Model was proposed by Young and Rubicam in 1993. The model uses self-administered questionnaires by mail and conducts consumer surveys every three years, covering 450 global brands in 19 countries and more than 8,000 regional brands in 24 countries.

The Brand Asset Valuator model believes that the successful building of a brand depends primarily on consumers and it is a process in which consumers recognize, accept, love and even trust a brand. In this process, the role of consumers cannot be ignored. As a result, the Brand Asset Valuator model uses questionnaires to understand how consumers perceive each brand in terms of differentiation, relevance, brand status, and brand knowledge. Based on the results of the survey, two factors, namely brand strength and brand stature, are established to build a brand force matrix that can identify the development stage of the brand (Qin, 2012).

### (4) Loyalty factor method

Based on customer behavior, Professor Fan xiucheng of Nankai University proposed the loyalty factor method in 2000. This method holds that the value of brand assets is brought about by the behavior of consumers, and the value of brand assets directly depends on consumers' preference for brands, so the evaluation of the value of brand assets should be based on consumers. Specifically, the value of brand assets should be calculated by the product of loyalty factor, number of cycles, periodic purchase quantity, consumer base and brand increment of unit product, among which consumer loyalty factor is the main factor affecting the value of brand assets. The specific formula is shown in 3.9.

$$V=Q \times N \times R \times (P-P_0) \times K \quad (3.9)$$

V: brand value

Q: periodic purchase quantity

N: number of cycles during the evaluation period

R: customer base

P: unit price of brand product

P<sub>0</sub>: unit price of non-branded product

K: loyalty factor

Loyalty factor is the key point of the whole formula and embodies the central idea of this method. The essence of loyalty factor is repeat purchase rate, which measures the proportion of consumers who intend to repeatedly purchase the brand products in the whole target group during the evaluation period. Loyalty factor is shown as the general trend of consumer behavior in a period of time, which is an important part of future expected revenue. The advantage of loyalty factor method is that the degree of consumer's concern for brand can be highlighted by data calculation, which emphasizes the key factors influencing the formation of brand value. The measurement of consumer factors is a beneficial supplement to the traditional brand value evaluation method, which can make up for the shortcoming of the financial-based assessment method.

Loyalty factor method also has some shortcomings. First, there is uncertainty between purchase intention and purchase behavior. In addition, the possibility and quantity of future purchases of different consumers are inconsistent, so it is difficult to accurately predict the consumer behavior. Second, for durable goods with a long repeated purchases cycle, the purchase intention and purchase behavior of consumers cannot be accurately understood through market research. Finally, this method only considers the brand awareness of consumers, but the depth of this level is far from enough.

### **3.3.4 Contrasts of assessment methods of different perspectives**

At present, there are many mainstream brand valuation methods in the world, but each method has its own applicability, advantages and disadvantages.

The biggest drawback of the financial-factors-based assessment methods is that it solely considers financial indicators and focuses on short-term financial indicators, which does not

reflect the richness of the intrinsic value of brand equity. So it easily leads to the maximization of short-term benefits of enterprises, which is not conducive to the management and marketing of brand assets. In addition, the cost method, stock market value method and income method are based on historical data for analysis, lacking consideration of future corporate strategy.

In the assessment methods based on market factors, the Financial World assessment method is actually modified based on the Interbrand assessment method. Therefore, it not only has the limitations of Interbrand, but is highly subjective as large amounts of data in this method are determined by experts based on experience and it has many economic assumptions.

The indicators of assessment methods based on consumer factors are relatively abstract and difficult to quantify, as many of them are mostly vague expressions. Since the number of consumers is large with substantial difference, quantification of consumer assessment is more likely to encounter subjective interference, which may affect the authenticity of the assessment results. At the same time, this kind of method lacks the consideration of financial indicators, which makes the brand equity evaluation appraisal like rootless wood.

### **3.4 Brief summary**

This chapter mainly studies the literature review of brand value. Firstly, the theory of brand management is elaborated in detail, including the definition of brand, the classification of brand, the characteristics of brand and other related concepts. Secondly, the theory of brand value is elaborated in detail, and the connotation and characteristics of brand value are introduced. Finally, according to the classification method of brand value, the relevant theories of brand value evaluation methods based on different perspectives are elaborated. It also elaborates and analyses their advantages and disadvantages in detail.

## **Chapter 4: Conceptual Model - Improvement based on Interbrand Model**

Through the above chapters, with comparative analysis of different evaluation methods of brand value, it is apparent that each evaluation method has its deficiencies as only one or two aspects have been taken into consideration. For this reason, this study will choose one evaluation method to remedy its deficiencies and through case study to apply and explain the improved model.

### **4.1 Principles for constructing evaluation system of brand value**

The evaluation indicator system can be gradually constructed after the internal and external sources of China's pharmaceutical enterprise brands have been understood. As China's pharmaceutical enterprise brands boast broad competition coverage, some principles should be followed in the construction process of the evaluation system of brand value of China's pharmaceutical enterprises:

#### **(1) Principle of science**

Jia and Yuan (2017) say that the realization of evaluation system of brand value of pharmaceutical enterprises requires the integration of theories with practice. It should not only accurately reflect the current conditions of pharmaceutical enterprise brands, but also reveal their internal structure and substantive characteristics. So the selected indicators should have sufficient bases, reasonable sources and accurate definitions so that they can both manifest the all aspects of connotations and characteristics of competitiveness of China's pharmaceutical enterprise brands and discover the problems of all factors.

#### **(2) Principle of systematization**

As a complicated process, brand value evaluation is the interaction of pharmaceutical enterprises' internal key factors and external environment factor, without which the brand value will fail to be evaluated in a comprehensive and systematic manner. In designing the evaluation indicator system, therefore, efforts should be made to reflect the relation and level of various factors of pharmaceutical enterprise brands. Only in this way can the indicator



system scientifically reflect the complete picture of brand value (Chen & Wang, 2018).

(3) Principle of integrating qualitative factors with quantitative factors

Zhou (2015) proposes that as the majority of brand value is sourced from pharmaceutical enterprises' internal training, after pharmaceutical products have been produced by pharmaceutical enterprises with the help of their own management, production and human capital, the ultimate purpose is to promote the products to the market and achieve sales profits. As a result, the evaluation indicators should integrate qualitative evaluation factors with quantitative ones. Only when the both factors are integrated can enterprises' brand value be reflected comprehensively and scientifically.

(4) Principle of practicability

Practicability means that the indicators should be simple and easy to be evaluated and operated, as any scientific and improved indicator system has to stand the test of practice. On the basis of ensuring comprehensive, authentic and objective evaluation results, this indicator system should be easy to be operated and used, and all data should be standard and normative so that the evaluation system of pharmaceutical brand value is universally applied to the evaluation and measurement of the brand value of any pharmaceutical enterprises (Zeng, 2016).

Therefore, the selected indicators should cover and generally summarize the competition of China's pharmaceutical enterprise brands, and at the same time the statistical data should be easy to be obtained and directly reflect the brand competition. In this way, the indicator system will be concise, convenient, feasible, operable and thus recognized by all the pharmaceutical industry.

## **4.2 Reasons for constructing the evaluation model from the perspective of consumers**

With the advent of the era of big data, Berry (2000) maintain that the sellers' market gradually evolves into the buyers' market, where consumers become the leading role. Considering the brand value origin and value formation mechanism, it is apparent that the brand value depends on consumers' future purchasing behaviors and willingness while such behaviors and willingness rest with enterprises' good brand image. Consequently, by formulating targeted brand marketing strategies, enterprises can improve consumers' differentiated cognition about their brand products and form differential advantages so as to

attract more loyal consumers.

According to the different evaluation methods of brand value presented in Chapter Three, it is observed that, currently, scholars mainly conduct researches on brand value evaluation from a single side of finance or market. There are also scholars who have paid attention to the importance of consumers to brand value formation, but there has not been a uniform conclusion on how to integrate finance, market with consumers in brand value evaluation and model construction.

The evaluation methods of brand value based on finance and market focus on enterprise financial effects and brand market status respectively, neglecting the importance of consumers to brand value formation and failing to take into consideration the final realization ways of brand value, which does not match the formation mechanism of brand value. Therefore, the brand value evaluation should be on the basis of consumers. Only in this way can it truly reflect the brand value.

### **4.3 The applicability analysis of interbrand model from the perspective of consumers**

Based on the comparative analysis of different evaluation methods of brand value, it is found that, with the constant development of market economy and brand theories, scholars begin to pay attention to consumers' important effect on brand value and emphasize the integration with the actual conditions of China's brands.

Although Brand Equity Ten model of Aaker's takes into consideration consumers' effect on brand value, this model only aims at exploring the factors influencing brand value from the perspective of consumers. Without stating the weight of ten factor indicators, it fails to accurately quantify brand value. In contrast, Interbrand evaluation model not only adopts the special grading method to quantify the weight of all dimensions of brand strength, but also reflects the rich brand connotations in the indicator design of brand strength. In quantifying brand multipliers, at the same time, it creates the "S-shaped" curve for the first time, which can more accurately evaluate brand value. Interbrand evaluation model combines finance, laws, marketing and other factors, and forms a relatively reasonable evaluation system of brand value.

In general, so far, Interbrand model is the most suitable evaluation method of brand value. So this study uses the Interbrand model as the foundation in the "building and application of

brand valuation model for pharmaceuticals companies in China”.

#### **4.3.1 Advantages of interbrand model**

Interbrand model mainly evaluates brand value based on financial indicators by taking market performance as the leading basis and takes money value as its result of brand evaluation. This model has stood the test of a span of 20 years and has been used by many global brands, receiving high attention and recognition from many scholars and experts as well as enterprises. It is safe to say that this model is relatively developed and is a globally initiative evaluation method, playing an important role in brand value evaluation. After analyzing its advantages and disadvantages, this thesis remedies its deficiencies so that the model becomes more suitable to the conditions of China's brands when evaluating the brand value of China's pharmaceutical industry. The advantages of Interbrand model mainly include the following aspects:

Firstly, as for the source of brand value, it is believed in this study that the brand can bring excess earnings to the company in the future. The Interbrand model is essentially a variant of the income method based on financial factors, which is in line with the view of the brand value source in this thesis. The Interbrand model is based on the traditional income method. In the assessment, the financial and market factors as well as the risk of brand earnings are taken into consideration.

Therefore, the results obtained are more comprehensive. By analyzing the financial factors in the evaluation process, it calculates the royalty rate of intangible assets. By analyzing the market factor, it adopts the indicator of “brand function index”, which arises from the attempt to reflect the differences of brands in different industries and product fields from multiple aspects. The adoption of this indicator excludes non-brand intangible assets' effect on prospective earnings and creatively resolves the difficulty of partitioning off brand asset contribution from intangible asset contribution, which is of guiding significance to the development of brand value evaluation theories and evaluation practice.

Secondly, the model gives up previous earnings prediction method and introduces the concept of brand strength that represents enterprises' sustainable operation ability. It conducts an analysis of brand strength value from seven levels, with a highest score in each level. And the total score of brand strength value is obtained through the expert grading method, stressing that the brand strength is determined by multiple factors. It uses S-shaped curve to match the brand strength value with specific discount rate. The brand strength determines the

brand multiplier, which is the reciprocal of applicable discount rate. The larger the brand multiplier is, the smaller the discount rate is, and vice versa. The creative practice that brand strength value combines the applicable discount rate of future brand earnings takes into consideration the influence of risk factors and quantifies the transformation from future brand earnings into actual earnings.

Finally, Interbrand model measures brand value based on future brand earnings and analyzes enterprises' sales volume, value of sales, profits and other aspects. As it relies more on the access to objective data, the evaluation results are reasonable to some extent. Besides, the model is very convenient for application, and the data needed for the assessment are relatively easy to obtain by analyzing the financial statements of the companies. The model has a history of more than 20 years and is widely used in practice. It is a mature assessment method and it is easy to verify the applicability of the model.

#### **4.3.2 Disadvantages of interbrand model**

Interbrand model evaluates brands based on brand assets' future earnings. It evaluates brand assets' value mainly by analyzing previous relevant financial indicators and predicting such indicators as net profits in the coming years. For mature brands, this is a relatively effective evaluation method, but of course, it has some limitations.

Firstly, brand strength is a unique concept introduced in the Interbrand model. But the design of the brand strength indicator system in the Interbrand model is not perfect and there is still room for improvement as for the targets and the specific contents. Interbrand model is currently considered to be a relatively authoritative evaluation method of brand value and its evaluation results have worldwide influence. But this method derives from overseas market and is mainly for those internationally well-known brands that are involved in transnational business operation, which goes against China's brand market environment. So this method is less applicable to Chinese brands.

Secondly, the brand strength in the Interbrand model lacks considerations of consumer factors. The lack of indicators in consumer cognition and attitude will, to some extent, reduce the persuasiveness of brand strength. In addition, the Interbrand model does not take into account the positive or negative impact of corporate social behavior and performance on brand.

Third, the analysis of brand strength is mainly conducted through Delphi method and expert opinion method, which centers on qualitative analysis and lacks quantitative analysis.

The weights of these factors in the Interbrand model are given, and whether they are reasonable is worth further discussion.

In the end, intangible assets' total revenue and brand-based future earnings are partitioned off from enterprise income and intangible assets' total revenue respectively, which is difficult to achieve in real operation. It is also difficult to comprehensively and reasonably determine the factors influencing intangible assets' total revenue. The Interbrand model uses the role of brand index to calculate contribution of the brand to the excess earnings of intangible assets, which is generally estimated by industry experts based on the market performance of the brand and is therefore highly subjective. All these factors will affect the reliability of the assessment results.

#### **4.4 Planned improvement contents based on interbrand model**

From the perspective of consumers, this thesis studies brand value evaluation to explore the real factors influencing brand value and construct an evaluation model that covers financial, market and consumer factors and that truly reflects brand value so as to further provide policy suggestions for China's pharmaceutical enterprises to improve their brand management capability. Therefore, based on the evaluation ideas of Interbrand model and Chinese brands' characteristics, we should make efforts to remedy the model's deficiencies from the perspective of improving value evaluation's rationality and construct a more scientific and reasonable value evaluation model that is suitable for Chinese brands so as to provide scientific and reasonable brand value basis for enterprises' external users and internal managers. We make the following improvements to the Interbrand model:

First, for the identification of the role of brand index, this thesis will use analytic hierarchy process to replace the original expert scoring method, making the index more objective and reducing the influence of subjectivity. For the determination of brand strength, AHP method will be adopted.

Second, when building the brand strength indicator system, based on the seven factors of market strength in the original model, this thesis adds consumer strength and social and cultural strength, so that the description of brand strength is more comprehensive.

Third, the weights of market strength, consumer strength and social and cultural strength will be adjusted accordingly.

## **4.5 Brief summary**

This chapter mainly introduces the conceptual model of this study. Firstly, it introduces the principles of building brand value evaluation system from an objective point of view, and analyses the reasons for choosing the consumer perspective to establish the evaluation model. Secondly, it analyses the applicability of the Interbrand model from the consumer perspective, and puts forward the rationality of building a brand value evaluation model suitable for Chinese pharmaceutical enterprises based on the Interbrand model. Finally, this chapter introduces the content of the proposed improvement of the Interbrand model.

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## **Chapter 5: Methodology**

### **5.1 Research method**

#### **5.1.1 Questionnaire method**

The questionnaire survey method is an important method for empirical research. It mainly selects pharmaceutical industry experts, financial experts, brand experts and potential capital partners in the pharmaceutical industry as the respondents. Literature analysis method is used to design pre-experiment questionnaires and then form a formal questionnaire. Questionnaires are sent out to ask experts to answer the questions. The indicators are selected through expert questionnaires to form a brand value evaluation indicator system for pharmaceutical companies in China.

#### **5.1.2 Expert consultation method**

Opinions of relevant experts are consulted anonymously and are added up, processed, analyzed, and generalized. Based on integration of expert experiences and subjective judgments, the author reasonably estimates a large number of factors that are difficult for quantitative analysis. After multiple rounds of expert consultation, feedback and adjustment, the method of analyzing the brand value and the degree to which it can be realized comes into being.

#### **5.1.3 Analytic hierarchy process**

Analytic Hierarchy Process (AHP) is a decision-making method that decomposes the elements that are always related to decision-making into targets, criteria, and programs, and then performs qualitative and quantitative analysis on this basis. In the quantification of brand strength, this study abandons the conventional method of expert scoring alone. Instead, it combines the scoring method with the analytic hierarchy process. Quantitative analysis and qualitative analysis are combined to identify the brand action index of the Chinese pharmaceutical industry and, in turn, to determine the weight of indicators in each hierarchy.



### 5.1.4 Fuzzy comprehensive evaluation method

Fuzzy comprehensive evaluation method is a comprehensive evaluation method based on fuzzy mathematics. According to the theory of membership degree of fuzzy mathematics, the comprehensive evaluation method transforms qualitative evaluation into quantitative evaluation, that is, to make a general evaluation of things or objects restricted by many factors with fuzzy mathematics. It has the characteristics of clear results and strong systematicness. It can better solve vague and difficult to quantify problems, and is suitable for solving various uncertain problems.

## 5.2 Improvement in brand earnings

To predict brand earnings, it is required to analyze enterprise profits resulting from brand products according to existing financial statement, market share and state of operation. The brand earning is the reflection of a brand's capability to obtain extraneous earnings in a certain period of time. It usually takes two steps to partition off brand profits from other profits:

Firstly, evaluate the earnings of intangible assets. In actual calculation, the earnings other than tangible assets-contributed earnings are the earnings of intangible assets, which reflect the contribution of intangible assets to enterprise income. By the way, the brand is a part of intangible assets.

Secondly, calculate the share of brand-contributed earnings to products or services in earnings of intangible assets, which is determined by brand function index.

### 5.2.1 Improvement in earnings of intangible assets

The formula of Interbrand model of brand value in this thesis is shown as follows:

$$V=P \times S \quad (5.1)$$

“V” stands for brand value, “P” for brand earnings and “S” for brand multipliers.

Interbrand evaluation method calculates earnings of intangible assets through enterprises' financial data and determines the brand function index through market analysis, that is, partitions off brand earnings from earnings of intangible assets.

(1) Brand earnings = earnings of intangible assets  $\times$  brand function index

$$P= I_{NA} \times R \quad (5.2)$$

“P” refers to brand earnings, “I<sub>NA</sub>” to earnings of intangible assets, and “R” to brand function index.

(2) Earnings of intangible assets = operating profits – earnings of tangible assets

$$I_{NA} = E_P - I_A \quad (5.3)$$

“E<sub>P</sub>” stands for enterprise operating profits and “I<sub>A</sub>” for earnings of tangible assets.

(3) Tangible assets are mainly composed of current assets and non-current assets. Among them, non-current assets in this thesis only count fixed assets.

$$I_A = A_{CT} \times \beta_{CT} + A_{FA} \times \beta_{FA} \quad (5.4)$$

“A<sub>CT</sub>” stands for current assets, “β<sub>CT</sub>” for rate of return of current assets, “A<sub>FA</sub>” for fixed assets and “β<sub>FA</sub>” for rate of return of fixed assets.

According to National Standard of People's Republic of China: *Brand Valuation--Multi-cycle Excess Earnings Method* published by General Administration of Quality Supervision, Inspection and Quarantine of China (2013), the rate of return of current assets (β<sub>CT</sub>) is based on the short-term benchmark interest rate for loan released by China People's Bank, such as one-year benchmark interest rate for bank loan. The rate of return of fixed assets (β<sub>FA</sub>) is based on the long-term benchmark interest rate for loan released by China People's Bank, such as five-year+ benchmark interest rate for bank loan.

(4) The predicted value of brand earnings is the weighted value of brand earnings that are endowed with different weights in the past three years. The formula is shown as follows:

$$P_{AR} = (P_0 \times 3 + P_1 \times 2 + P_2 \times 1) / (3 + 2 + 1) \quad (5.5)$$

“P<sub>AR</sub>” refers to brand's weighted average earnings

“P<sub>0</sub>” refers to the brand earnings in the current year

“P<sub>1</sub>” refers to the brand earnings in the previous year

“P<sub>2</sub>” refers to the brand earnings in the past two years

### 5.2.2 Determining the brand function index

In Interbrand evaluation method, the significance of brand function index is to separate brand-contributed earnings. As for enterprises, intangible assets that produce excess earnings include not only brands' role but also service level, marketing level and other intangible assets. Interbrand model determines the brand function index through expert grading, involving lots

of subjective factors. As a result, this thesis adopts a more scientific Analytic Hierarchy Process (AHP) to determine the brand function index so as to reduce subjective factors' negative effect on evaluation results.

Proposed by a US mathematician named Saaty (1980), AHP is a multi-objective decision-making method integrating subjective and objective factors as well as qualitative analysis and quantitative analysis. This method first determines the objective, and based on this objective, it divides this object into several sub-objects in multiple levels and analyzes the importance of each sub-object. The specific process is shown as follows:

(1) Constructing analytic hierarchy model

To construct a reasonable and systematic hierarchical structure, it means to, on the basis of specifying decision-making objectives, methodize the main factors of decisions so as to construct a hierarchical structural model. The hierarchy generally includes three layers: lay of objective, layer of principles and layer of solutions, wherein the layer of objective refers to the objective to be analyzed, which is shown in Figure 5-1.

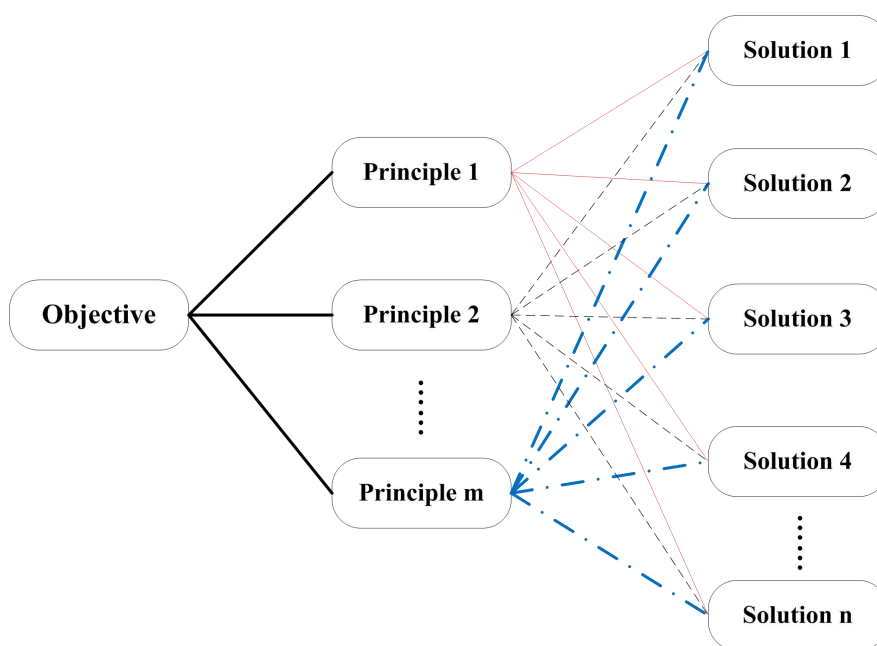


Figure 5-1 Structure of analytic hierarchy process

(2) Pairwise comparison and grading to construct a judgment matrix

After constructing the model, expert grading is usually used in analysis process to compare the effect degree of various factors and their upper factors, thus obtaining the score of importance of each factor through layer-by-layer comparison. The dimensional scaling of 1-9 and reciprocals is often used, whose scores are shown in Table 5-1.

Table 5-1 Definition of dimensions of analytic hierarchy process

Dimension $A_{ij}$	Definition
1	Factor i and factor j are equally important
3	Factor i and Factor j are moderately important
5	Factor i and Factor j are relatively important
7	Factor i and Factor j are strongly important
9	Factor i and Factor j are extremely important
2,4,6,8	The importance of Factor i and Factor j stands at the average level of the above scaling
$1/A_{ij}$	If the importance of Factor i and Factor j is $A_{ij}$ , the ratio of the importance of Factor j and Factor i will be $1/A_{ij}$

The judgment matrix is constructed based on the comparison results:  $A_{ij}$  refers to the effect degree of Factor i on the layer of principle of Factor j, and  $A_{ij}$  and  $A_{ji}$  are reciprocals.

$$A_{ij} = \begin{bmatrix} a_{11} & a_{12} & a_{13} & a_{14} & \dots & a_{1j} \\ a_{21} & a_{22} & a_{23} & a_{24} & \dots & a_{2j} \\ a_{31} & a_{32} & a_{33} & a_{34} & \dots & a_{3j} \\ a_{41} & a_{42} & a_{43} & a_{44} & \dots & a_{4j} \\ \dots & \dots & \dots & \dots & \dots & \dots \\ a_{i1} & a_{i2} & a_{i3} & a_{i4} & \dots & a_{ij} \end{bmatrix}$$

$i, j = 1, 2, 3 \dots n.$

(3) Obtaining weight vectors through single ordering of layers

Next, the weight vectors of judgment matrix can be obtained through single ordering of layers, i.e.: obtaining judgment matrix's largest Eigenvalue and its corresponding eigenvector:

$$AW = \lambda W$$

According to the above formula, we can obtain the maximal eigenvalue  $\lambda_{max}$ . Its corresponding eigenvector is  $W$ , and the weight vector can be obtained through normalization processing of  $W$ .

(4) Consistency check

In order to ensure the accuracy of weight vector, we need to check the consistency. The consistency index (CI) is therefore introduced, which refers to judgment matrix's deviation degree of complete consistency.

$$CI = \frac{\lambda - n}{n - 1} \tag{5.6}$$

Considering the deviation of consistency may be caused randomly, when checking whether judgment matrix has satisfactory consistency, it is required to compare CI and

random consistency index (RI) to obtain the check coefficient (CR):

$$CR = \frac{CI}{RI} \quad (5.7)$$

The random consistency index (RI) is shown in Table 5 in Appendix 2.

If  $CR < 0.1$ , it is believed that the judgment matrix passes the consistency check; or otherwise the judgment matrix is required to be adjusted.

#### (5) Total ordering of layers

Total ordering of layers refers to conducting the total ordering through the calculation of combined weight of each layer of factor in total objective so as to determine the importance of each factor of the bottom layer of the structure in the total objective. This process is conducted from the top layer to the bottom layer.

### 5.3 Improvement of brand strength

Brand strength is a concept that describes the degree of effect of different factors on brand value. A scientific, accurate and reasonable calculation and selection of brand strength can exert a profound influence on the authenticity and reliability of the evaluation results of brand value. Based on the seven elements of Intel Corporation, the thesis constructs reasonable brand strength through appropriate additions and deletions.

Brand strength factor identification mainly focuses on qualitative analysis of the factors, which is the first step in brand management. A comprehensive and systematic identification of brand strength factors is the basis of brand value management research. Therefore, it is necessary to choose a reasonable method to comprehensively and accurately identify the factors affecting the brand strength in the pharmaceutical industry. This thesis employs the questionnaire survey method to obtain the first-hand materials in the identification of brand strength factors, initially identifies the factors influencing the brand strength of China's pharmaceutical industry, and then sifts out the real factors through the Delphi Expert Interview Method. The factors are finally quantitatively evaluated by the Fuzzy Comprehensive Evaluation Method to determine the scores of the brand strength indicators of China's pharmaceutical industry, laying a foundation for the brand value calculation of the latter part of the thesis.

### 5.3.1 Questionnaire survey

#### (1) Questionnaire survey

Before the questionnaire survey, this thesis comprehensively analyzes the actual situation of the Chinese pharmaceutical industry market based on literature reading and completes the design of the final questionnaire. The thesis mainly collects data from a total of 500 questionnaires through on-site survey.

The on-site answering is mainly for random interviews in large pharmaceutical enterprises, hospitals, pharmacies with random respondents, such as managerial staff from Nanfang Hospital of Southern Medical University, and related respondents from LBX Pharmacy, Nepstar Chain Drugstore Ltd. and other customers who purchase medicines. The advantage of the on-site answering is that the survey scope is relatively accurate and the sample size of this channel is finally determined to be 500.

#### (2) Contents of the questionnaire

The questionnaire can be divided into the following four parts:

The first part is preface and the purpose of designing this part is to convey some information to the respondents, such as the reasons for the survey, the identity of the investigator, the content of the survey, and the confidentiality of the survey results, thus ensuring a smooth progress of the survey.

The second part mainly involves the basic survey information of the respondents, including gender, age, educational level, job position, monthly income, and considerations for purchasing medical products.

The third part mainly requires the respondents to extend the relevant contents in the questionnaire, that is, to supplement the influencing factors of customers' behavior in purchasing related medical products according to their own situation.

#### (3) Main parameters in the questionnaire

This questionnaire mainly aims at investigating the factors related to the brand strength of China's pharmaceutical industry, and initially improving the brand strength factors in the Interbrand model through questionnaires.

#### (4) Collection of the questionnaires

The channels for collecting the required data and materials in this thesis are mainly through the on-site answering. The survey was held from December 5, 2018 to January 15,

2019, including the design, distribution, collection and sorting of the questionnaires. A total of 500 questionnaires were distributed and 443 questionnaires were collected. The questionnaire recollection rate reached 88.6%. A total of 23 invalid questionnaires, including the obvious perfunctory and missed questionnaires, were removed, and 420 valid questionnaires were finally obtained. The summary and displaying situation of the valid questionnaires is shown in Table 5-2.

Table 5-2 Statistics overview of the questionnaire results

Items		Number	Percentage
Gender	Male	204	48.57%
	Female	216	51.43%
Age	Below 20	45	10.71%
	21-35	224	53.33%
	36-50	137	32.62%
	Above 50	14	3.33%
Educational Level	Senior high school and below	33	7.86%
	Associate degree	91	21.67%
	Bachelor's degree	182	43.33%
Occupation	Master's degree and above	114	27.14%
	Managerial staff	128	30.48%
	Professional technical staff	106	25.24%
	Grassroots service staff	114	27.14%
Monthly Income (RMB*)	Others	72	17.14%
	Below 4000	66	15.71%
	4001-7000	133	31.67%
	7001-10000	117	27.86%
	Above 10000	104	24.76%

Note: RMB, Renminbi, abbreviated as RMB; currency code is CNY; currency symbol is ¥, is the legal currency of the People's Republic of China, the unit of RMB is yuan.

In terms of gender, the ratio of males to females in this questionnaire survey is relatively coordinated, which basically meets the balanced needs of male and female samples.

In regard of age, the proportion of those of 21-35 years old is 53.33%, and that of those of 36-50 years old is 32.62%. The sum of these two age groups exceeds 85% of the total number of people surveyed, and the proportion of those above 50 years old in the survey takes up only 3.33%, which ensured that most of the respondents in this questionnaire are adults who know the brands better and frequently contact with them.

From the perspective of educational level, only 7.86% are at the educational level of senior high school or below, indicating that the majority of respondents in this survey have received higher education and have a clear understanding of the problem. This can effectively ensure the accuracy of the data.

From the scope of work, it covers managerial staff, professional technical personnel, grassroots service personnel and other types, and the job types are comprehensive.

In the aspects of monthly income level, the proportion of those who earn below 4,000 yuan per month is only 15.71%, which indicates that the current living standards of the people are improving and the economic strength is generally enhanced. People pay attention to brand factors when purchasing medical products, and this also ensures the effectiveness of data collection to a certain extent.

In addition, the survey removed the respondents who did not purchase medical products in the past two years to ensure the validity of the questionnaire, so the survey data presents a certain degree of credibility.

After the questionnaire survey, there were 32 factors initially identified that influence the brand strength of China's pharmaceutical industry, which laid the foundation for the following adoption of the Delphi Expert Interview Method.

### **5.3.2 Delphi expert interview method**

The Delphi method, also known as the Expert Survey Method, was proposed by the American RAND Corporation in 1946 and is the method used to identify the brand strength factors in this thesis. The general procedure for this method is shown in Figure 5-2.

There are two cores in Delphi method: First, anonymity, experts are anonymous to each other, so they can avoid mutual influence; second, feedback, the collected opinions will be processed and then fed back to experts, which is conducive to the convergence of opinions.

The participation of high-level experts is one of the key factors for the success of brand value evaluation and these experts' abundant practical experience is crucial to the influence of



brand value evaluation.

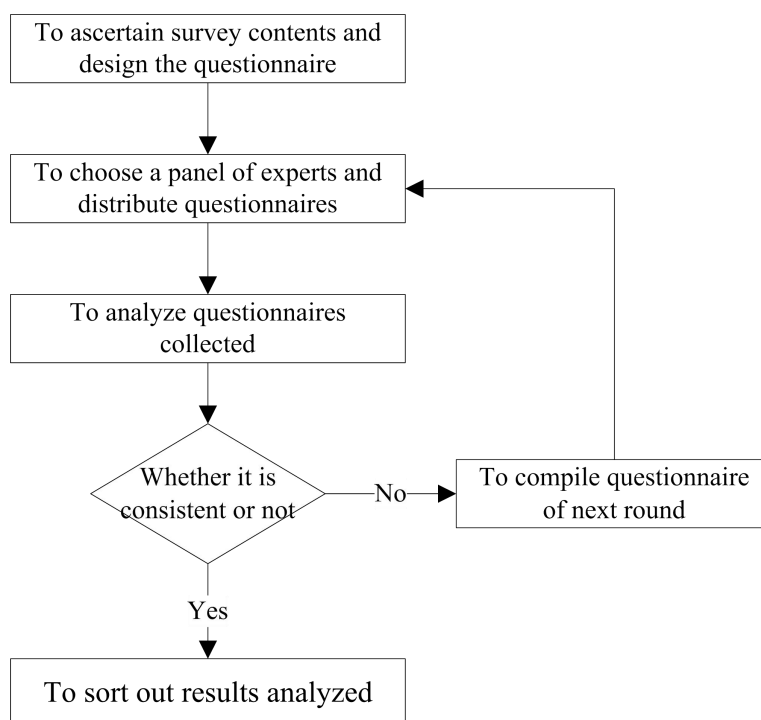


Figure 5-2 Delphi method process

In this study, 20 experts from various fields were selected for consultation. Their backgrounds are shown in Table 5-3.

Table 5-3 Expert background

Experts	Number	Types of Working Unit
Mid-and-upper managers of pharmaceutical enterprises'	5	Pharmaceutical industry
Researchers of medical universities and related institutes	3	School/scientific institution
Experts from large-scale third-grade class-A hospitals	3	Hospital
Practical pharmacists of medical products administration	2	Government
Experts of China Pharmaceutical Innovation and Research Development Association	2	Social organizational institution
Researchers from National Brand Development Research Center	5	Research agency

In order to make the indicator evaluation system comprehensive, objective, systematic and feasible, this thesis identifies 31 influencing factors in the brand value of Chinese pharmaceutical enterprises' through the previous questionnaire survey, and then identifies

them by the Delphi method. After four rounds of investigations with the Delphi method, the experts' opinions tend to be consistent and finalized. The specific process is shown in Figure 15 in Appendix 1. On the basis of the questionnaire survey and through the Delphi method, 20 experts are invited to tick the 31 factors that they believe influencing the brand of Chinese pharmaceutical enterprises, and the factors finally determined by the experts are determined as the factors influencing the brand. After four rounds of scoring, the experts' opinions are unified. The first round of experts' scoring through the Delphi method is shown in Table 5-4.

Table 5-4 Experts' first-round scoring through the delphi method

Orders	Influencing Factors of Brand Strength	Numbers of Ticks
1	Leadership of brands in the market	18
2	Development years of brands	17
3	Growth and stability of the market in which the brand is located	20
4	The ability of brands to cross national geographic and cultural boundaries	18
5	Consistency with social development trends	20
6	Degree of governmental support	18
7	The extent to which the brand is protected by law	19
8	Brand research and development efforts	19
9	Promotion of brands	16
10	Searching times of brands in Chinese in Baidu	3
11	Establishment of a specialized brand management department	4
12	Entrusting a brand consulting company to plan	4
13	Number of product brands	3
14	Whether it has passed GMP standards or other management system certification	18
15	Legal and compliant operation	18
16	Number of complaints about product brands	3
17	Honest taxation	19
18	Public welfare support	19
19	Advertisement investment	2
20	Product or service improved based on consumer opinions	3
21	Emphasis on and investment in environmental protection	17
22	Is it a China's time-honored brand?	18
23	Corporate culture system construction	18
24	Quality of brand spokesperson	6
25	Employees care	18
26	Brand identification	17
27	Brand recognition	18
28	Brand association	18

29	Chinese goods complex	2
30	Brand loyalty	19
31	Product recommendations	16

After the first round of expert scoring, the experts' opinions are not unified. Therefore, opinions are collected, processed, and then anonymously feedback to experts. The second round of experts' scoring through the Delphi method is shown in Table 6 in Appendix 2.

After the second round of expert scoring, the experts' opinions are not unified again. The third round of experts' scoring through the Delphi method is shown in Table 7 in Appendix 2.

The fourth round of experts' opinions of Delphi method is unified. The details are shown in Table 8 in Appendix 2.

### 5.3.3 Improvement of brand strength factors

According to the final results of the Delphi method, the improved new model based on the Interbrand value evaluation model has 22 basic indicator factors, which are leadership, stability, market, internationality, trend, support, protection, innovation, corporate integrity, social responsibility, corporate culture, customers' attitude and customers' behavior. The entire indicator system is measured by three dimensions: market strength, social and cultural strength, and consumers' strength. As shown in Table 5-5.

#### (1) Market strength

In the reconstructed brand strength indicator system, the market indicators include Interbrand's original seven indicators and newly added innovation capabilities.

##### ① Leadership

It refers to the brand's leading position in the pharmaceutical industry, reflecting the influence of brand development on the market. Only a brand with a higher status in the industry can have a voice in the industry and be in an invincible position in the market competition. Generally speaking, brands with strong market leadership have great influence and high brand value.

##### ② Stability

Compared with the new-born brands, the long-term and continuous brands have more influence and appeal, stronger anti-risk ability and higher brand value. The thesis measures the stability of the brand by its age. The longer the profitability of the brand is evaluated, the higher its stability is.

③ Market

The nature of the market actually reflects the market environment in which pharmaceutical enterprises are located, and is generally the performance of the market atmosphere in which the brand is located. An open and fair industry can provide a harmonious atmosphere for the development of competitive mechanisms. Under normal circumstances, brands that perform well in the market, and are rich in growth and stability, are more competitive.

Table 5-5 Brand strength indicators in China's pharmaceutical industry

Dimension	First Level Indicators	Basic Indicators
Market Strength	Leadership	Leadership of brands in the market
	Stability	Development years of brands
	Market	Growth and stability of the market in which the brand is located
	Internationality	The ability to cross national geographic and cultural boundaries
	Trend	Consistency with social development trends
	Support	Degree of governmental support
	Protection	The extent to which the brand is protected by law
	Innovation	Brand research and development efforts
	Capabilities	Promotion of brands
	Corporate Integrity	Whether it has passed GMP standards or other management system certification
Social and Cultural Strength	Social Responsibility	Legal and compliant operation
		Honest taxation
		Public welfare support
		Emphasis on and investment in environmental protection
Customer	Corporate Culture	Is it a China's time-honored brand?
		Corporate culture system construction
		Employees care
Customer	Customers' Attitude	Brand identification

Strength	Brand recognition
	Brand association
Customers' Behavior	Brand loyalty
	Product recommendations

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#### ④ Internationality

It reflects pharmaceutical enterprises' ability to cross cultural and geographic boundaries. Internationally strong brand products, being less geographically restricted, can integrate multiple cultures for global operations and have more customers' groups than regional and local brands, as well as higher and relatively stable economic returns in transnational operations. The degree of internationalization is one of the core competitive advantages of transnational enterprises.

#### ⑤ Trend

Trend is to measure the future development of pharmaceutical enterprises' brands in line with social needs and development trends. The development of pharmaceutical enterprises should keep pace with the times, be consistent with the development trend of the social environment, and be able to continuously adapt to customers' changing needs. Generally, the higher the degree of consistency, the more it can satisfy the customers' needs, hence the higher its brand value is.

#### ⑥ Support

It reflects the attention and support mainly from the government, society and financial institutions to pharmaceutical enterprises' brands. Support mainly reflects the effectiveness of the communication between the brand and the target market group. Generally, the higher the degree of continuous investment and long-term support of a brand internally and externally has, the stronger the ability of the enterprise expand, so is the brand value.

#### ⑦ Protection

The brand protection of pharmaceutical enterprises includes not only the degree of protection of assets such as trademark rights, but also the enterprises' capability to eliminate adverse effects and deal with public opinion crisis when brands are affected by negative news. The stronger the legal protection of intangible assets such as patents and trademarks, the higher the score of brand protection; the faster the enterprise handles negative events and the better the elimination of negative effects, the stronger the brand's capability to withstand risks

and the higher the enterprise's brand power.

⑧ Innovation capabilities

The pharmaceutical industry belongs to the high-tech industry. The innovation capabilities of enterprises can not only promote the development of industry technology, but also enhance the competitiveness of enterprises through innovation. The successful brand requires high-quality products as a prerequisite, and high-quality products come from the enterprise's technological innovation level. Therefore, the R&D industry with research as the core is the driving force for the development of medicine and the brand innovation capabilities of pharmaceutical enterprises are measured from two aspects: brand R&D efforts and promotion efforts.

Brand R&D efforts: It is the primary factor for evaluating brand innovation capabilities, mainly considering brand technology R&D investment, brand R&D expenditure and the percentage of brand R&D expenditure in the operating income.

Brand promotion efforts: The construction of corporate brand is inseparable from the scientific brand promotion, which is an indispensable part of brand management. The proportion of brand promotion expenditure to income, the expenses of advertising investment, and fees paid to brand spokespersons are all indicators of brand promotion levels.

(2) Social and cultural strength

Nowadays the increasingly homogenized products can hardly attract customers' attention in the long run only with useful function and high quality. Only brands with individuality and cultural connotation will be favored by customers and create a high brand premium. Products can be easily imitated by competitors, but the value, culture and individuality of the brand are difficult for competitors to learn in a short time. Strong brands all have profound cultural connotations and culture plays a positive role in strengthening brand competitiveness and improving target customers' awareness of and loyalty to brands. The social and cultural strength mainly includes three indicators: corporate integrity, social responsibility, and corporate culture.

① Corporate integrity

The issue of corporate integrity is a hot spot and focus of public attention in recent years. Integrity is a valuable intangible asset of an enterprise. The integrity of pharmaceutical enterprises is related to their survival and development, and it is more important to the health and safety of thousands of households.

GMP: Quality management practices for pharmaceutical production. Quality is the foundation of the establishment and development of pharmaceutical brands and even their life. GMP standard is a system for ensuring continuous production of pharmaceutical products with the specified quality and GMP certification indicates the basic integrity of pharmaceutical enterprises. GMP standard can guarantee enterprises to meet the sanitary quality requirements in terms of raw materials, personnel, facilities and equipment, production process, packaging and transportation and quality control according to relevant national laws and regulations, and form a set of operational specifications to help enterprises improve the corporate health environment.

Legal and compliant management: Pharmaceutical enterprises must strictly abide by the relevant laws and regulations such as the Pharmaceutical Administration Law, implement relevant documents and notification requirements of the state, provinces and municipalities in a timely manner, and truthfully report the pharmaceutical operations, quality and safety of the enterprises.

## ② Social responsibility

The social responsibility of brand has become a recognized indicator of high standards and strict requirements of world-class enterprises. Creating a brand image with high sense of social responsibility has become a powerful means of enhancing the value of corporate brands. Mahabubur, Angeles, and Mary (2019) thinks that there is a synergistic connection between brand equity and corporate social responsibility which increases long-term value of corporate. Pharmaceutical products have a certain degree of social welfare so that the pharmaceutical enterprises need to consciously assume social responsibilities, change and adjust public relations and strategies, and are responsible for human health.

Honest taxation: Socialist taxation is “taken from the people and used by the people” and is closely related to the people's lives. The effectiveness of taxation collection is directly related to the realization process of a well-off society. The honest taxation of pharmaceutical enterprises is conducive to creating a good tax environment and forming a social atmosphere of “honest taxation based on law” in the whole society.

Public welfare support: This reflects the social responsibility of corporate brands and displays the brand value from a social perspective. The public welfare support of a brand refers to its overall investment in public welfare undertakings, including the promotion of the development of culture, education, health, charity, environmental protection and other causes. The development of pharmaceutical enterprises in public welfare and related aspects will

enhance customers' good impression upon the brand, thus guiding their purchasing behavior.

Emphasis on and investment in environmental protection: As the public's awareness of environmental protection continues to increase, the attention and investment of pharmaceutical enterprises' in environmental protection has gradually become the standard for customers to measure the social behavior of pharmaceutical enterprises. Customers' good perception of the brand is closely related to the healthy and positive corporate image of pharmaceutical enterprises. In the evaluation of the brand strength of a pharmaceutical enterprise, environmental protection capability is an essential part.

### ③ Corporate culture

Corporate culture has strong cohesiveness and appeal. It is an important part of product connotation, and the core of brand building. Excellent culture is the life pillar of the brand and the source of the brand's continuous vitality. Without the nourishment of culture, the brand will soon die out. Only with the support and guidance of the right culture will the brand be full of vitality and the development of the enterprise will be everlasting.

China time-honored brand: In January 2017, the Ministry of Commerce and other 16 departments issued *Guiding Opinions on Promoting the Reform and Innovation of the Time-honored Brands*, to strengthen the inheritance and protection of the time-honored enterprises, and pay attention to the brand value and re-development of their brands. (China time-honored brand: It refers to a brand with a long history, inherited products, skills or services from generation to generation, distinct Chinese traditional cultural background and profound cultural connotation, which has been widely recognized by the society and formed a good reputation.) The significance of the Chinese time-honored brand to modern society lies in its memory of the fine traditions of the Chinese nation, the business ethics of cheating no customers, the spirit of craftsmanship and the invaluable experience of integrity.

Corporate culture system: Corporate culture is a unique cultural form of an enterprise. It embodies strength domestically and displays the corporate posture to the outside world. Excellent corporate cultural system has strong cohesiveness, good sense of teamwork and innovation, strong anti-risk capability and competitive competence, fueling the sustainable development of the enterprise.

Employee care: Employee care is the enterprise's "people-oriented" core concept and the basic guarantee for the healthy growth of employees and the sustainable development of the enterprise. The enterprise's care to its employees is an important part of corporate culture.



This kind of care originates from the enterprise's awareness of its mission and is also the inheritance and development of the traditional Chinese culture.

### (3) Customers' strength

Without customers, there will be no brand. The market is made up of customers and the brand value is achieved through the exchange of products. Brand is the relationship between products and customers, representing the “agreement” between brand operators and customers. The brand loyalty based on broad customers' psychological identity is the core of brand value.

#### ① Customers' attitude

Brand identification: It is an indicator to measure customers' understanding of the connotation, value and attributes of product brands and the brand awareness that customers form after accepting brand communication or using products. Higher brand awareness can drive customers' purchasing behavior.

Brand recognition: It refers to customers' recognition of product quality and service. Brand identification is the premise of brand recognition. After customers use the product, the positive brand recognition attitude will be formed if their feelings are consistent with the expectations before the purchase. Brand recognition incorporates the customers' subjective feelings on the basis of brand identification, which can have a greater influence on customers' future purchase decisions. In fact, customers do not have the ability to objectively judge the quality of products in many cases. Therefore, the recognition referred here targets the products perceived and recognized by customers, not necessarily concerning the objective difference in the quality of the products.

Brand association: There is a strong interrelationship between product sales and brand association. Therefore, in shaping the brand image, we should try our best to establish and accumulate positive brand association for the brand through various marketing channels. In turn, it creates a lasting impression on customers and strengthens the brand's market advantages.

#### ② Customers' behavior

Brand loyalty: Oliver (1999) defines it as “a commitment to re-buy a product or service”. This kind of subjective preference for a particular brand is mainly derived from the customers' purchasing experience, and the enterprise's marketing activities will also strengthen the customers' preference subtly. Nam, Ekinci, and Whyatt (2011) maintain that brand loyalty is not only the component of brand equity, but also the outcome. Besides, Tolba

and Hassan (2009) and Buil, Martinez, and Chernatony (2013) acknowledge a causal relationship between brand equity and brand loyalty. Loyal customers of a brand will rely on this brand's products and exclude other brands of similar products. Even as the brand expands its product line, customers will continue to choose the brand's products.

Product recommendations: In addition to their own multiple purchases, customers will also recommend products to others. The product recommendation rate reflects the extent to which the brand promise is recognized by customers, and indicates the proportion of people who are willing to recommend a product to a certain number of sample populations.

### 5.3.4 Application of fuzzy comprehensive evaluation method

The Fuzzy Comprehensive Evaluation Method originates from the concept of fuzzy sets proposed by Zadeh (1965) and is mainly used to solve uncertain problems. The method uses Fuzzy Mathematics Membership Theory to transform qualitative problems into quantitative evaluations. In the fuzzy processing of relations, the Fuzzy Comprehensive Evaluation Method can obtain qualitative results of qualitative problems that are not easy to quantify. This method is based on fuzzy mathematics theory and the model of Fuzzy Comprehensive Evaluation is:

$$B=WR=(W_1, W_2, W_3, \dots W_m) \begin{bmatrix} r_{11} & r_{12} & r_{13} & \dots & r_{1j} \\ r_{21} & r_{22} & r_{23} & \dots & r_{2j} \\ r_{31} & r_{32} & r_{33} & \dots & r_{3j} \\ \dots & \dots & \dots & \dots & \dots \\ r_{i1} & r_{i2} & r_{i3} & \dots & r_{ij} \end{bmatrix}$$

The basic steps are:

(1) To determine the index set composed of Fuzzy Comprehensive Evaluation factors U,  $U=(U_1, U_2, U_3 \dots U_m)$ .  $U_i(i=1, 2, 3 \dots m)$  as the evaluation factor.

(2) To determine the comment set for the evaluation factor V.

$V = (V_1, V_2, V_3, \dots V_n)$ .  $V_i (i = 1, 2, 3 \dots n)$  as an available comment determined in advance.

(3) To ascertain the membership of every single factor for each rating. The membership degree of qualitative indicators is obtained by fuzzy statistics. A single factor evaluation judgment matrix R shall be determined to judge the fuzzy relationship between the evaluation factor U and the comment set V.

(4) To determine the weight of each factor,  $W=(W_1, W_2, W_3 \dots W_m)$ . In the Fuzzy Comprehensive Evaluation, the weight distribution is an important issue. The thesis uses the

analytic hierarchy process to establish a pair wise judgment comparison matrix. In a certain standard, the weight of each candidate element shall be calculated and the ranking weight of the current layer element be further calculated with respect to the total target; the consistency indicator shall be employed to perform the consistency test and when the test value is less than 0.1, the consistency can be passed.

(5) To conduct a Fuzzy Comprehensive Evaluation through compound operation.  $B=WR$ , and make a specific judgment according to the calculation results.

## **5.4 Brief summary**

This chapter first introduces the research methods of this study, including questionnaire survey, expert scoring, analytic hierarchy process and fuzzy mathematics. Then, according to specific research methods, the calculation process of brand revenue and brand strength is improved.

## Chapter 6: Case Application

### 6.1 Research subjects

#### 6.1.1 Introduction to Y Company

##### (1) Overview of Y Company

As a time-honored Chinese brand founded in 1902, Y Company enjoys extensive reputation at home and abroad. In 1993, it was listed as the first company from Yunnan Province on the Shenzhen Stock Exchange. In 2005, it employed the product strategy of “ensuring the core products and launching two new businesses”. The year 2010 witnessed the beginning of its growth from an enterprise specialized in producing Chinese patent medicine into a leading enterprise in China's massive health industry, after it adopted the industrial strategy called “developing new products into massive health industry” that year. In 2017, the company made a profit of 24.315 billion yuan with sound and stable business management indicators. With a variety of products popular with Chinese and Southeast Asian customers, the company entered new markets of European and North American countries as well as Japan and intended to expand the share. Operated in multidivisional structure, Y Company consists of five parts: Yunnan pharmaceutical Co., Ltd, Pharmaceutical Division, Health Division, Chinese Medicine Resources Division, and R&D (Research & Development) Innovation Center. The organizational structure is shown in Figure 16 in Appendix 1.

##### (2) Major business and products

With a time-honored brand of over one hundred years, Y Company enjoys high recognition in pharmaceutical industry and plays a leading role in its field. It deals in a wide range of products including chemical raw medicines, chemico-pharmaceutical preparations, Chinese patent medicine, Chinese medicinal materials, biological products, cosmetics, and personal care products, which are produced in three major lines: Y Baiyao, panax notoginseng (sanqi), and medicine with Yunnan ethnic characteristics. Based on the product lines and services, businesses of the group are divided into four sectors: medicine, health products, Chinese medicine resources, and pharmaceutical commerce, which are shown in Figure 17 in Appendix 1.

In recent years, the group has been adaptive to the new normal of industry development and focused on the upgrading trend of consumption. By taking innovation of products and business modes as a breakthrough, the group constantly improves the corporate business strategies and consolidates its development foundation by tapping internal potential, strengthening operation management, and adjusting the innovation of product structure, technology, and business mode, therefore enabling a steady increase in both developing vitality and economic benefits. Each business sector actively reforms its channels and employs products according to market demands.

① In accordance with China's medical and pharmaceutical reform measures like the two-invoice policy, the medicine sector quickly adjusts its distribution model to ensure that product distribution meets national requirements. (two-invoice policy: It refers to the invoice issued by the drug dealer from the pharmaceutical factory to the first-class distributor, and the second invoice issued by the distributor from the hospital, replacing the seven or eight common invoices with two invoices, reducing the layers of circulation links, and the number of first-class distributors of each variety shall not exceed two.)

It is bold in the exploration in industrial product field while prudent in product deployment, probing into the application of modern Internet channel within the scope of We-business. In terms of products, while continuing to strengthen the layout of therapeutic products of the group, the sector sifts through internal approval resources and thus promotes the construction of pharmaceutical consumer products system in response to the growing trend of consumer demand for such products. In addition, the sector accelerates the R&D and promotion of the steam eye mask and other industrial personal care products, in order to build a Chinese medicine platform for treatment and care.

② The health products sector actively embraces the Internet. In addition to selling products in flagship stores on major e-commerce platforms, the department keeps abreast of the development of new retail era in light of product features and gradually initiates a new pattern of Internet channels for health products after establishing the Internet Marketing Center in Hangzhou. Meanwhile, on the basis of the existing oral care, hair care, skin care, and personal hygiene products, its business covers more products and services to create a comprehensive all-round personal health care ecosystem with methods such as independent R&D.

③ As for the pharmaceutical commerce sector, the department continues to adjust its channel layout in accordance with national medical reform policies. While customizing

services for county-or-above level medical institutions to effectively maintain the advantages of existing channels, the sector explores by law the coordinated development of offline channels like retail pharmacy business and pharmacy trusteeship, and online channels like online medicine sales.

④ The Chinese medicine resources sector continues to implement new business models such as “O2O” and develops offline channels in the province. Meanwhile, the sector combines the product experience with membership and traditional Chinese medicine health services and establishes the membership system that facilitates precisely targeted health products and services provided for customers (members). As for products, the sector makes full use of abundant resources in Yunnan to build a development system of Chinese medicinal materials industry chain based on strategic varieties, and at the same time, advances the construction of Chinese herbal health products platform with diversified product lines in which new products such as four-season health products, balanced meals, and medicated herbal packages are under successful R&D and promotion.

### (3) Market layout

Y Company has entered the overseas market since the 1930s when Baibaodan (a drug that could cure many diseases) produced by the brand founder Qu Huanzhang, had been exported to Southeast Asian countries and other parts of the world. In recent years, thanks to the company's brand foundation, industrial base, and resource integration capabilities and under the guidance of the “developing new products into massive health industry” strategy, the group based in Yunnan and rooted in China follows national strategic plans for the Belt and Road Initiative and strengthens the international deployment of the brand and products. Besides, global resources are gathered effectively to facilitate organized internationalization of the group in multiple fields, including product, brand, market, talents, and capital.

At present, the group's trademark has been registered in many countries where the trademark has been licensed for 157 products. Core products are available in regions such as Hong Kong, Macao, Taiwan and Southeast Asian countries like Singapore. Some products have entered the United States, Japan, Canada, South Africa and other markets. According to the product features, the group carries out promotion activities in overseas markets to make the brand and products more appealing. By promoting the internationalization of Chinese medicine products and culture, the group also contributes to the “going global” policy of the Chinese culture.

### (4) Innovation and R&D

Y Company integrates the concept and practice of innovation into all aspects of production, operation, and management. By further implementing refined management, the group strengthens the process control over of finance, raw material procurement, production management, market sales, and corporate culture construction and keeps them interconnected at any time to increase management efficiency. Committed to the open R&D model, the group has established close cooperative relations with well-known Chinese research institutions in the production of new chemical medicine and biological medicine and is building the forward-looking innovative R&D product chain of new medicine and improved product chain with clinical value and technical characteristics to enhance R&D capabilities. Thanks to the systematic R&D mechanism, the group has independent, continuous, and effective R&D and innovation capabilities without prejudice to product quality, which further increases the technological content of products and solidifies the competitive advantages of its products.

### **6.1.2 Analysis of brand positioning of Y Company**

#### **(1) Product positioning**

The pharmaceutical industry is typically technology-intensive, and the technical processing and R&D innovation of Chinese medicine requires greater technical input and more in-depth efforts into R&D. Y Company products whose production techniques and formula have been listed as national top secrets have non-replicable uniqueness in curative effects. The secret recipe is one of the two varieties of traditional Chinese medicine in grade one protection. Besides, Y Company owns 101 invention patents, 26 utility models and 284 design patents, and has won a number of authoritative awards in science and technology. As for product performance, aerosols and adhesive bandages of the group have become front-runners among similar medicines for traumatic injury. By improving production techniques and R&D of technology, Y Company has produced brand-related Chinese patent medicines, preparations, daily necessities, hygiene products, and medical equipment which take competitive share in the main product markets.

As the inheritor for excellent culture of over a hundred years, Y Company focuses on innovation and changes by integrating traditional Chinese medicine into modern life and achieving health quality life with medical technology, which explains its successful shift from a traditional Chinese medicine brand to a modern brand for health consumption. In this sense, the product structure and production process of Y Company determine that products of the group are technically high-tech intensive.

## (2) Brand positioning

In the brand building, the group fully exploits the potential and connotation of the famous golden brand “Y” and incorporates brand building into the overall development strategy. After defining the core value and positioning of the parent brand, the group standardizes the brand system, clarifies the brand positioning, and builds a multi-brand development system. For example, in addition to core products under the brand “Y”, Y Toothpaste in the field of household chemicals has dominated a share of 17.8% in China's toothpaste market, ranking second among toothpaste brands in China.

In terms of brand management, Y Company adheres to the principle of “best products, best service, and best brand”. It musters the brand resources of Y and develops the brand and its value through inheritance and crossover transformation, therefore realizing the leap from a traditional Chinese medicine brand to a modern brand of massive health consumption. With prescription known worldwide and national top-secret formula, Y Company makes efforts in the long-term production and operation and has been for several times on lists for the most valuable brands, such as BRANDZ Brands and Hurun Brands. Besides, many of its trademarks have been designated as national famous ones and the brand has been awarded the title of Appealing Time-Honored Chinese Brand. These honors have positive publicity impact on the public attention to the brand and brand popularity, improve the brand value and corporate image, and greatly contribute to the promotion and market supervision of the company's products.

In conclusion, “Y” can be defined as a high-tech brand after a comprehensive analysis of the industry nature, the group's research capabilities, product structure, product performance in the market, and brand positioning.

### **6.1.3 Data sources**

The object of this study is Y Company, which is the first company in China to apply Interbrand method. From this, it can be seen that the company possess the theoretical application margin and practical feasibility in the pharmaceutical industry and the field of brand value evaluation. As a leader in the pharmaceutical industry, Y Company has certain brand value research significance and can make certain practical operation research contribution to the brand value evaluation research.

The original data of this thesis are all from National Bureau of Statistics, Annual Report



of Y Company (2015-2017) and the questionnaire survey, and part of the industry data are from the information of relevant pharmaceutical industry websites.

## **6.2 Evaluation elements**

### **6.2.1 Purposes of evaluation**

The purpose of this brand value evaluation is to reflect the market value of the brand of Y Company, verify the rationality of the improved Interbrand model, and provide reference for improving strategies to enhance the brand value of the pharmaceutical industry.

### **6.2.2 Evaluation hypothesis**

Evaluation hypothesis refer to the hypothesis that is made through the inference of objective and normal development rules when encountering something that has not been confirmed or cannot be confirmed through normal channels during the evaluation process. The common evaluation hypothesis includes transaction hypothesis, open-market hypothesis, continuing operation hypothesis and liquidation hypothesis. This thesis evaluates the brand value of Y Company based on the following hypothesis:

#### **(1) Open-market hypothesis**

Open-market hypothesis refers to that there are enough suppliers and consumers in a perfect market and buyers and sellers are in a competitive market characterized by equality and information symmetry and buying and selling are both spontaneous rational behaviors. This hypothesis, to some extent, stipulates and limits the conditions under which capital enters the competitive market and the influence it receives. When evaluating the brand value of Y Company, this thesis believes that the obtained financial reports and other materials are completely true and belong to the open-market hypothesis.

#### **(2) Continuing operation hypothesis**

This hypothesis first assumes that the assessed assets are in use, including the assets in use and standby assets; secondly, based on relevant data and information, it can be inferred that these assets in use will continue to be used. The continuing operation hypothesis not only describes the market conditions or market environment of the assessed assets, but also emphasizes the existence status of the assets. When evaluating the brand value of Y Company , this thesis assumes that no major events affecting the property rights of Y Company brand

occur in a period of time after the base date of assets evaluation, the technologies and equipment adopted by Y Company do not significantly change and do not affect the market competitiveness of Y Company brand and the sales of products remain stable.

(3) Real data hypothesis

The data cited and collected in the evaluation process of this thesis are from national bureau of statistics and annual reports of Y Company, etc., which have certain credibility. This thesis also assumes that the financial information of Y Company is compiled in accordance with China's current accounting standards and in line with the relevant policies and regulations.

(4) Other special hypothesis

Under the three basic hypothesis: open-market hypothesis, continuing operation hypothesis and real data hypothesis, this evaluation shall also include the following special hypothesis:

① During the base date of assets evaluation, the external economic environment will remain unchanged and no major changes will take place in the country's current macro-economy.

② No significant change takes place in the social and economic environment in which the enterprise is located and the tax and tax rate and other policies implemented.

③ The values of various parameters measured and calculated in this evaluation do not take into account the impact of inflation.

### **6.2.3 Base date of assets evaluation**

The selection of the base date of assets evaluation is the primary condition for brand asset evaluation since the asset structure, profit status and corporate image of an enterprise will always change over time and the development of the enterprise, and the evaluation results of the enterprise brand value will vary significantly in different time periods. According to the disclosure time of the 2017 annual report of Y Company and taking all aspects of the evaluated brand into consideration, the base date assets evaluation of this brand value evaluation is determined to be December 31, 2017.

## 6.3 Evaluation process of the brand value of Y Company

### 6.3.1 Determination of earnings of intangible assets of Y Company

After consulting Annual Report of Y Company (2015-2017), we extract factors of both earnings and profits and losses including operating revenues, costs of sales, administration, finance, properties and plants and impairment losses of equipment from the financial data of Shanghai Pharma. The specific financial data in the last three years is shown in Table 9 in Appendix 2.

#### (1) Calculation of earnings of tangible assets

Tangible assets mainly consist of current assets and non-current assets while only fixed assets of non-current assets are calculated in this thesis. According to the calculation formula of earnings of tangible assets 5.4, earnings of tangible assets=current assets  $\times$  rate of return of current assets +fixed assets  $\times$  rate of return of fixed assets. Here, according to the interest rates of short-term and long-term benchmark loans announced by the People's Bank of China (POB), the rate of return of current capitals  $\beta_{CT}$  is 4.35% and the rate of return of fixed assets  $\beta_{FA}$  is 4.9%. Therefore, earnings of tangible assets can be figured out as Table 10 in Appendix 2 shows.

#### (2) Calculation of earnings of intangible assets

According to Formula 5.3, earnings of intangible assets=operating revenues-earnings of tangible assets. Therefore, earnings of intangible assets can be figured out as Table 6-1 shows.

Table 6-1 Earnings of intangible assets of Y Company (2015-2017) (Unit: yuan/RMB)

Project \ Year	2015	2016	2017
Operating Revenue	3,168,241,317.67	3,319,829,663.97	3,620,723,532.36
Earning of Tangible Asset	815,677,122.6	1,047,278,043.45	1,177,527,943.3
Earning of Intangible Asset	2,352,564,195.07	2,272,551,620.52	2,443,195,589.06

### 6.3.2 Determination of indicators of the brand effect of Y Company

There are many reasons for pharmaceutical companies to obtain excess returns. By studying the relevant information of the pharmaceutical industry and related theoretical principles, this thesis summarizes the main reasons for the profit generated by pharmaceutical companies: quality advantage, price advantage and competitive advantage. Through a large

amount of literature and analysis of existing research results, this thesis considers quality advantages, price advantages and competitive advantages. The creation of these three advantages comes from enterprise brand, technology level, marketing strategy and other factors.

Analytic hierarchy process (AHP) is an analysis method that combines qualitative analysis and quantitative analysis. Through AHP, the thesis effectively separates factors of intangible assets including enterprise brand, service level and marketing advantages, and gets their contribution to the intangible assets of the pharmaceutical industry so as to determine the coefficients of brand effect. This method, simple in principle and easy to operate, can be applied to the practice of brand value assessment. The target layer is the excess earning of intangible assets of the pharmaceutical industry, the criterion layer is intended to consist of quality advantage, price advantage, and competition advantage, and the scheme layer includes enterprise brand, service level, marketing capacity and other factors. The AHP structure model of brand effect indicators of Y Company is shown in Figure 6-1.

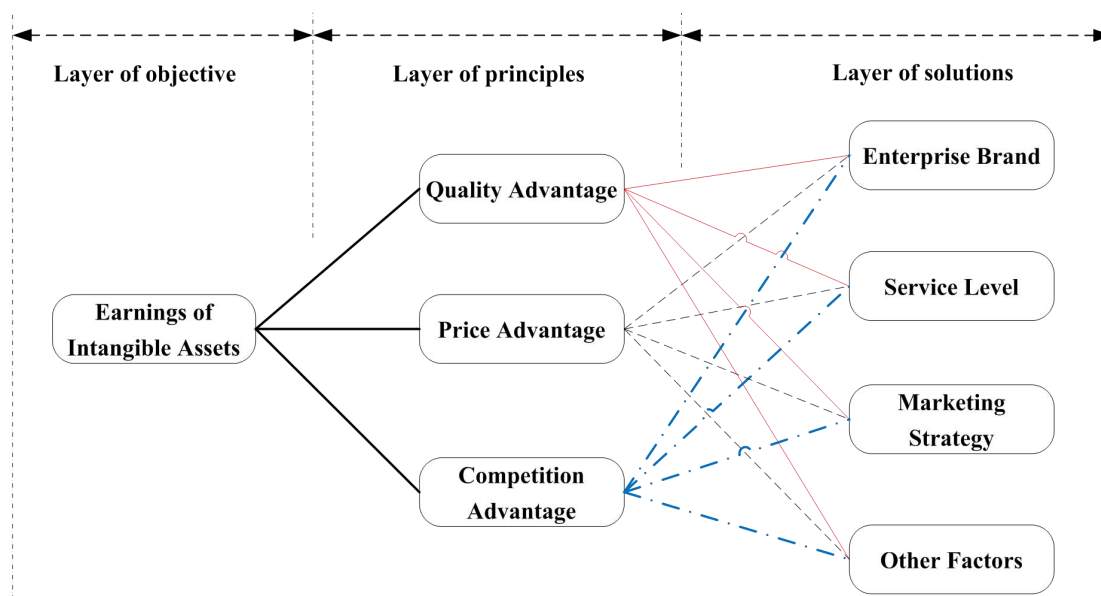


Figure 6-1 AHP model of earnings of intangible assets of the brand

(1) Determination of weights of the criterion layer

After knowing the principle of AHP, we need to collect data according to the idea of AHP, and then determine the weight of each indicator with AHP. After discussion by 20 experts, the judgment matrix A of the criterion layer can be obtained, as is shown in Table 11 in Appendix 2.

The calculation process of weights is as follows:

**Step 1:** normalizing every column of factors in A;

**Step 2:** adding the normalized rows;

**Step 3:** dividing the summed vectors by n to get the weight vectors.

$$A = \begin{bmatrix} 1 & 5 & 2 \\ 1/5 & 1 & 1/2 \\ 1/2 & 2 & 1 \end{bmatrix} = \begin{bmatrix} 1 & 5 & 2 \\ 0.2 & 1 & 0.5 \\ 0.5 & 2 & 1 \end{bmatrix} \xrightarrow{\text{normalization of column vectors}} \begin{bmatrix} 0.5882 & 0.625 & 0.5714 \\ 0.1176 & 0.125 & 0.1428 \\ 0.2941 & 0.25 & 0.2857 \end{bmatrix} \xrightarrow{\text{arithmetic mean of row vectors}} \begin{bmatrix} 0.5948 \\ 0.1285 \\ 0.2766 \end{bmatrix} = W$$

To secure an objective and scientific final result, it is necessary to ensure that the judgment matrix A achieves consistency. In the case where  $CR < 0.1$  and the consistency of the judgment matrix is within the allowable range, the eigenvector can be regarded as the weight vector. The check process of consistency is as follows:

$$AW = \begin{bmatrix} 1 & 5 & 2 \\ 0.2 & 1 & 0.5 \\ 0.5 & 2 & 1 \end{bmatrix} \begin{bmatrix} 0.5948 \\ 0.1285 \\ 0.2766 \end{bmatrix} = \begin{bmatrix} 1.7905 \\ 0.3857 \\ 0.831 \end{bmatrix} = \lambda W$$

$$\lambda = \frac{1}{3} \left( \frac{1.7905}{0.5948} + \frac{0.3857}{0.1285} + \frac{0.831}{0.2766} \right) = 3.0054$$

$$CI = \frac{\lambda - n}{n - 1} = \frac{3.0054 - 3}{3 - 1} = 0.0027$$

When  $n=3$ ,  $RI=0.58$ , and  $CR = \frac{CI}{RI} = \frac{0.0027}{0.58} = 0.0046 < 0.1$ , the consistency check is passed.

Therefore, according to the above calculation result, weights of the criterion layer are shown in Table 6-2.

Table 6-2 Weights of the criterion layer

General Target	Weight
Quality Advantage	0.5948
Price Advantage	0.1258
Competition Advantage	0.2766

## (2) Determination of weights of indicators of quality advantages

After discussion by 20 experts, the judgment matrix B1 of quality advantages can be obtained, as is shown in Table 12 in Appendix 2.

The calculation process of weights is as follows:

**Step 1:** normalizing every column of factors in B1;

**Step 2:** adding the normalized rows;

**Step 3:** dividing the summed vectors by n to get the weight vectors.

$$B_1 = \begin{bmatrix} 1 & 2 & 4 & 5 \\ 1/2 & 1 & 2 & 3 \\ 1/4 & 1/2 & 1 & 2 \\ 1/5 & 1/3 & 1/2 & 1 \end{bmatrix} = \begin{bmatrix} 1 & 2 & 4 & 5 \\ 0.5 & 1 & 2 & 3 \\ 0.25 & 0.5 & 1 & 2 \\ 0.2 & 0.3333 & 0.5 & 1 \end{bmatrix} \xrightarrow{\text{normalization of column vectors}}$$

$$\begin{bmatrix} 0.5128 & 0.5217 & 0.5333 & 0.4545 \\ 0.2564 & 0.2609 & 0.2666 & 0.2727 \\ 0.1282 & 0.1304 & 0.1333 & 0.1818 \\ 0.1026 & 0.0869 & 0.0667 & 0.0909 \end{bmatrix} \xrightarrow{\text{arithmetic mean of row vectors}} \begin{bmatrix} 0.5056 \\ 0.2642 \\ 0.1434 \\ 0.0868 \end{bmatrix} = W_1$$

The check process of consistency is as follows:

$$B_1 W_1 = \begin{bmatrix} 1 & 2 & 4 & 5 \\ 0.5 & 1 & 2 & 3 \\ 0.25 & 0.5 & 1 & 2 \\ 0.2 & 0.3333 & 0.5 & 1 \end{bmatrix} \begin{bmatrix} 0.5056 \\ 0.2642 \\ 0.1434 \\ 0.0868 \end{bmatrix} = \begin{bmatrix} 2.0416 \\ 1.2378 \\ 0.5755 \\ 0.3477 \end{bmatrix} = \lambda W_1$$

$$\lambda = \frac{1}{4} \left( \frac{2.0416}{0.5056} + \frac{1.2378}{0.2642} + \frac{0.5755}{0.1434} + \frac{0.3477}{0.0868} \right) = 4.1855$$

$$CI = \frac{\lambda - n}{n - 1} = \frac{4.1855 - 4}{4 - 1} = 0.0618$$

When  $n=4$ ,  $RI=0.90$ ,  $CR = \frac{CI}{RI} = \frac{0.0618}{0.90} = 0.0687 < 0.1$ , the consistency check is passed.

Therefore, weights of quality advantages are shown in Table 6-3.

Table 6-3 Weights of quality advantages

Quality Advantage B <sub>1</sub>	Weight
Enterprise Brand	0.5056
Service Level	0.2642
Marketing Strategy	0.1434
Other Factors	0.0868

### (3) Determination of weights of indicators of price advantages

After discussion by 20 experts, the judgment matrix B<sub>2</sub> of price advantages can be obtained, as is shown in Table 13 in Appendix 2.

The calculation process of weights is as follows:

**Step 1:** normalizing every column of factors in B<sub>2</sub>;

**Step 2:** adding the normalized rows;

**Step 3:** dividing the summed vectors by n to get the weight vectors.

$$B_2 = \begin{bmatrix} 1 & 1/2 & 1 & 3 \\ 2 & 1 & 2 & 5 \\ 1 & 1/2 & 1 & 3 \\ 1/3 & 1/5 & 1/3 & 1 \end{bmatrix} = \begin{bmatrix} 1 & 0.5 & 1 & 3 \\ 2 & 1 & 2 & 5 \\ 2 & 0.5 & 1 & 3 \\ 0.3333 & 0.2 & 0.3333 & 1 \end{bmatrix} \xrightarrow{\text{normalization of column}}$$

$$\xrightarrow{\text{vectors}} \begin{bmatrix} 0.2308 & 0.2273 & 0.2308 & 0.25 \\ 0.4615 & 0.4545 & 0.4615 & 0.4167 \\ 0.2308 & 0.2273 & 0.2308 & 0.25 \\ 0.0769 & 0.0909 & 0.0769 & 0.0833 \end{bmatrix} \xrightarrow{\text{arithmetic mean of row vectors}} \begin{bmatrix} 0.2347 \\ 0.4486 \\ 0.2347 \\ 0.082 \end{bmatrix} = W_2$$

The check process of consistency is as follows:

$$B_2 W_2 = \begin{bmatrix} 1 & 0.5 & 1 & 3 \\ 2 & 1 & 2 & 5 \\ 1 & 0.5 & 1 & 3 \\ 0.3333 & 0.2 & 0.3333 & 1 \end{bmatrix} \begin{bmatrix} 0.2347 \\ 0.4486 \\ 0.2347 \\ 0.082 \end{bmatrix} = \begin{bmatrix} 0.9397 \\ 1.7974 \\ 0.9347 \\ 0.3281 \end{bmatrix} = \lambda W_2$$

$$\lambda = \frac{1}{4} \left( \frac{0.9397}{0.2347} + \frac{1.7974}{0.4486} + \frac{0.9347}{0.2347} + \frac{0.3281}{0.082} \right) = 4.0536$$

$$CI = \frac{\lambda - n}{n - 1} = \frac{4.0536 - 4}{4 - 1} = 0.0179$$

When  $n=4$ ,  $RI=0.90$ ,  $CR = \frac{CI}{RI} = \frac{0.0179}{0.90} = 0.0199 < 0.1$ , the consistency check is passed.

Therefore, weights of price advantages are shown in Table 6-4.

Table 6-4 Weights of price advantages

Price Advantage B <sub>2</sub>	Weight
Enterprise Brand	0.2347
Service Level	0.4486
Marketing Strategy	0.2347
Other Factors	0.082

(4) Determination of weights of indicators of competition advantages

After discussion by 20 experts, the judgment matrix B<sub>3</sub> of competition advantages can be obtained, as is shown in Table 14 in Appendix 2.

The calculation process of weights is as follows:

**Step 1:** normalizing every column of factors in B<sub>3</sub>;

**Step 2:** adding the normalized rows;

**Step 3:** dividing the summed vectors by n to get the weight vectors.

$$B_3 = \begin{bmatrix} 1 & 3/2 & 3 & 4 \\ 2/3 & 1 & 5/2 & 2 \\ 1/3 & 2/5 & 1 & 3/2 \\ 1/4 & 1/2 & 2/3 & 1 \end{bmatrix} = \begin{bmatrix} 1 & 1.5 & 3 & 4 \\ 0.6667 & 1 & 2.5 & 2 \\ 0.3333 & 0.4 & 1 & 1.5 \\ 0.25 & 0.5 & 0.6667 & 1 \end{bmatrix} \xrightarrow{\text{normalization of column}}$$

$$\xrightarrow{\text{vectors}} \begin{bmatrix} 0.4444 & 0.4412 & 0.4186 & 0.4706 \\ 0.2963 & 0.2941 & 0.3488 & 0.2353 \\ 0.1481 & 0.1176 & 0.1395 & 0.1765 \\ 0.1111 & 0.1471 & 0.0930 & 0.1176 \end{bmatrix} \xrightarrow{\text{arithmetic mean of row vectors}}$$

$$\begin{bmatrix} 0.4437 \\ 0.2936 \\ 0.1454 \\ 0.1172 \end{bmatrix} = W_3$$

The check process of consistency is as follows:

$$B_3 W_3 = \begin{bmatrix} 1 & 1.5 & 3 & 4 \\ 0.6667 & 1 & 2.5 & 2 \\ 0.3333 & 0.4 & 1 & 1.5 \\ 0.25 & 0.5 & 0.6667 & 1 \end{bmatrix} \begin{bmatrix} 0.4437 \\ 0.2936 \\ 0.1454 \\ 0.1172 \end{bmatrix} = \begin{bmatrix} 1.7891 \\ 1.1873 \\ 0.5865 \\ 0.4718 \end{bmatrix} = \lambda W_3$$

$$\lambda = \frac{1}{4} \left( \frac{1.7891}{0.4437} + \frac{1.1873}{0.2936} + \frac{0.5865}{0.1454} + \frac{0.4718}{0.1172} \right) = 4.0339$$

$$CI = \frac{\lambda - n}{n - 1} = \frac{4.0339 - 4}{4 - 1} = 0.0113$$

When  $n=4$ ,  $RI=0.90$ ,  $CR = \frac{CI}{RI} = \frac{0.0113}{0.90} = 0.0126 < 0.1$ , the consistency check is passed.

Therefore, weights of competition advantages are shown in Table 6-5.

Table 6-5 Weights of competition advantages

Competition Advantage $B_3$	Weight
Enterprise Brand	0.4437
Service Level	0.2936
Marketing Strategy	0.1454
Other Factors	0.1172

According to the above calculation results, the brand accounts for 45.29% of the intangible assets of Y Company, as is shown in Table 6-6.

### 6.3.3 Determination of earnings of the brand of Y Company

As the brand accounts for 45.29% of the intangible assets of Y Company, the earnings of intangible assets of Y Company can be figured out. As shown in Table 6-7.



Table 6-6 Weights of factors of intangible assets of Y Company

Criterion Layer	Quality Advantage	Price Advantage	Competition Advantage	Weight
Scheme Layer	0.5948	0.1258	0.2766	
Enterprise Brand	0.5056	0.2347	0.4437	0.4529
Service Level	0.2642	0.4486	0.2936	0.2477
Marketing Strategy	0.1434	0.2347	0.1454	0.1907
Other Factors	0.0868	0.0820	0.1172	0.1007

Table 6-7 Earnings of the brand of Y Company(2015-2017) (Unit: yuan/RMB)

Project \ Year	2015	2016	2017
Earning of Intangible Asset	2,352,564,195.07	2,272,551,620.52	2,443,195,589.06
Proportion of Brand in Intangible Asset	45.29%	45.29%	45.29%
Earning of Brand	1,065,476,323.94	1,029,238,628.93	1,106,523,282.28

According to Formula 5.5, the predicted value of earnings of the brand is the weighted value obtained by assigning different weights to earnings of the brand in the past three years, that is, the average earnings of the brand=(earnings of the brand in 2017×3+earnings of the brand in 2016×2+earnings of the brand in 2015×1)/6.

Therefore, earnings of the brand of Y Company  $P=(1,106,523,282.28 \times 3+1,029,238,628.93 \times 2+1,065,476,323.94 \times 1)/6=1,073,920,571.44$  Yuan RMB.

### 6.3.4 Determination of the brand strength of Y Company

#### (1) Establishment of the AHP model of the brand strength of Y Company

Based on the indicators of brand strength in Table 5-5, we establish the model of influencing factors of the brand strength of pharmaceutical industry with AHP. This indicator system consists of three indicators including market strength, social culture strength and consumer strength, as is shown in Figure 6-2.

#### (2) Determination of weights of indicators of brand strength

##### ① Determination of weights of the criterion layer

After knowing the principle of AHP, we need to collect data according to the idea of AHP,

and then determine the weight of each indicator with AHP. After discussion by 20 experts, the judgment matrix A of the brand strength criterion layer of Y Company can be obtained, as is shown in Table 15 in Appendix 2.

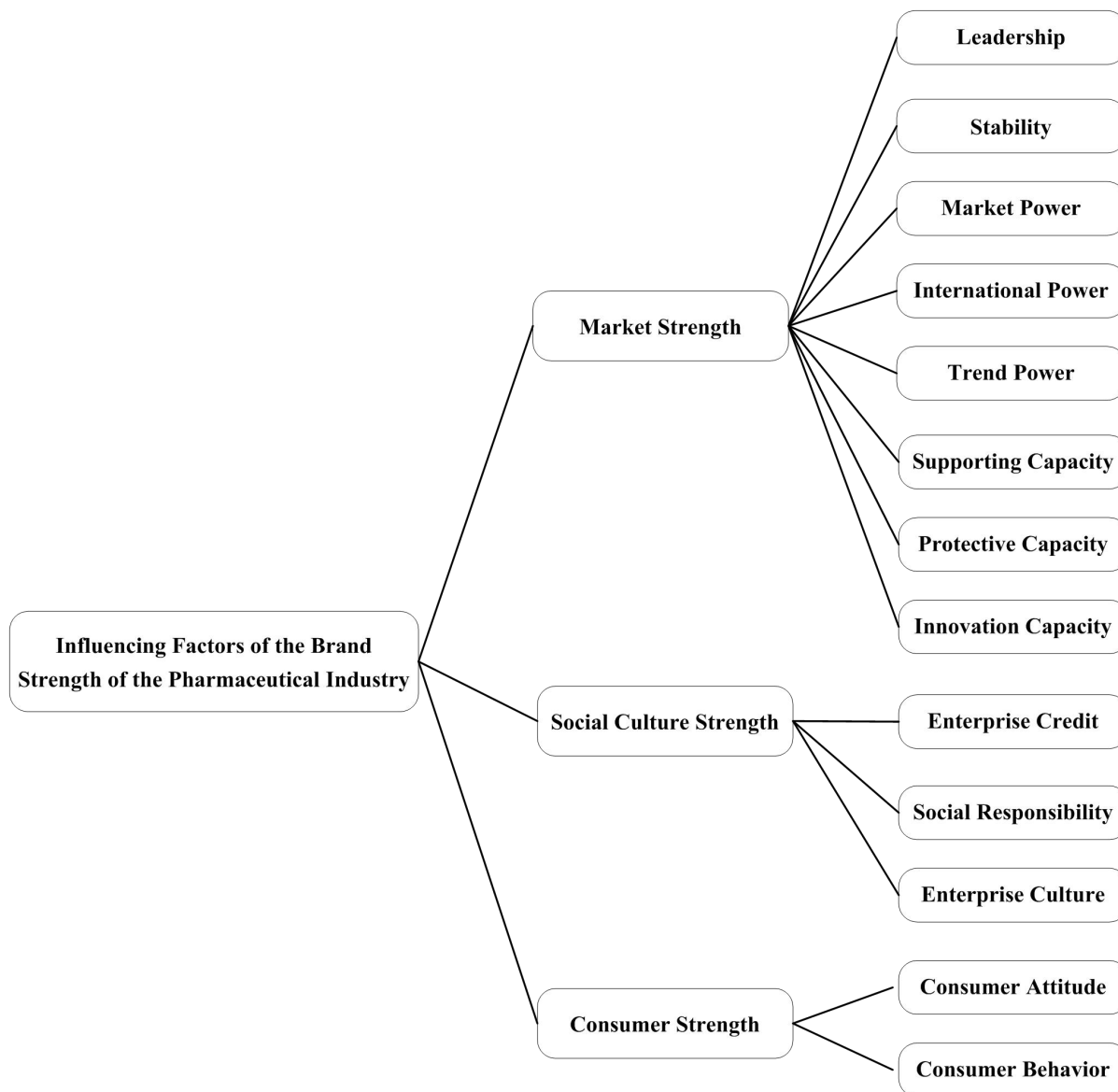


Figure 6-2 Model of the brand strength of the pharmaceutical industry

The calculation process of weights is as follows:

**Step 1:** normalizing every column of factors of A;

**Step 2:** adding the normalized rows;

**Step 3:** dividing the summed vectors by n to get the weight vectors.

$$A = \begin{bmatrix} 1 & 4 & 3 \\ 1/4 & 1 & 1/2 \\ 1/3 & 2 & 1 \end{bmatrix} = \begin{bmatrix} 1 & 4 & 3 \\ 0.25 & 1 & 0.5 \\ 0.3333 & 2 & 1 \end{bmatrix} \underline{\underline{\text{normalization of column}}}$$

$$\begin{bmatrix} 0.6315 & 0.5714 & 0.6666 \\ 0.1579 & 0.1429 & 0.1111 \\ 0.2105 & 0.2857 & 0.2222 \end{bmatrix} \text{arithmetic mean of row vectors} \begin{bmatrix} 0.6232 \\ 0.1373 \\ 0.2395 \end{bmatrix} = W$$

To secure an objective and scientific final result, it is necessary to ensure that the judgment matrix A achieves consistency. In the case where  $CR < 0.1$  and the consistency of the judgment matrix is within the allowable range, the eigenvector can be regarded as the weight vector. The check process of consistency is as follows:

$$AW = \begin{bmatrix} 1 & 4 & 3 \\ 0.25 & 1 & 0.5 \\ 0.3333 & 2 & 1 \end{bmatrix} \cdot \begin{bmatrix} 0.6232 \\ 0.1373 \\ 0.2395 \end{bmatrix} = \begin{bmatrix} 1.8909 \\ 0.4129 \\ 0.7569 \end{bmatrix} = \lambda W$$

$$\lambda = \frac{1}{3} \left( \frac{1.8909}{0.6232} + \frac{0.4129}{0.1373} + \frac{0.7569}{0.2395} \right) = 3.0673$$

$$CI = \frac{\lambda - n}{n - 1} = \frac{3.0673 - 3}{3 - 1} = 0.0336$$

When  $n=3$ ,  $RI=0.58$ , and  $CR = \frac{CI}{RI} = \frac{0.0336}{0.58} = 0.0579 < 0.1$ , the consistency check is passed.

Therefore, weights of the criterion layer are shown in Table 6-8.

Table 6-8 Weights of the criterion layer

General Target	Weight
Market Strength	0.6232
Social Culture Strength	0.1373
Consumer Strength	0.2395

② Determination of weights of factors of market strength

After discussion by 20 experts, the judgement matrix  $B_1$  of market strength is obtained, as is shown in Table 16 in Appendix 2.

The calculation process of weights is as follows:

$$B_1 = \begin{bmatrix} 1 & 4/3 & 2 & 3/2 & 2 & 5/2 & 4 & 3/2 \\ 3/4 & 1 & 3/2 & 7/6 & 3/2 & 9/5 & 3 & 7/6 \\ 1/2 & 2/3 & 1 & 3/4 & 1 & 5/4 & 2 & 4/5 \\ 2/3 & 6/7 & 4/3 & 1 & 4/3 & 5/3 & 8/3 & 1 \\ 1/2 & 2/3 & 1 & 3/4 & 1 & 5/4 & 2 & 3/4 \\ 2/5 & 5/9 & 4/5 & 3/5 & 4/5 & 1 & 8/5 & 3/8 \\ 1/4 & 1/3 & 1/2 & 3/8 & 1/2 & 5/8 & 1 & 3/8 \\ 2/3 & 6/7 & 5/4 & 1 & 4/3 & 8/3 & 8/3 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} 1 & 1.3333 & 2 & 1.5 & 2 & 2.5 & 4 & 1.5 \\ 0.75 & 1 & 1.5 & 1.1667 & 1.5 & 1.8 & 3 & 1.1667 \\ 0.5 & 0.6667 & 1 & 0.75 & 1 & 1.25 & 2 & 0.8 \\ 0.6667 & 0.8571 & 1.3333 & 1 & 1.3333 & 1.6667 & 2.6667 & 1 \\ 0.5 & 0.6667 & 1 & 0.75 & 1 & 1.25 & 2 & 0.75 \\ 0.4 & 0.5556 & 0.8 & 0.6 & 0.8 & 1 & 1.6 & 0.375 \\ 0.25 & 0.3333 & 0.5 & 0.375 & 0.5 & 0.625 & 1 & 0.375 \\ 0.6667 & 0.8571 & 1.25 & 1 & 1.3333 & 2.6667 & 2.6667 & 1 \end{bmatrix} \text{normalization}$$

$$\text{of column} \begin{bmatrix} 0.2113 & 0.2127 & 0.2131 & 0.21 & 0.2113 & 0.1959 & 0.2113 & 0.2153 \\ 0.1584 & 0.1595 & 0.1599 & 0.1634 & 0.1585 & 0.1411 & 0.1585 & 0.1675 \\ 0.1056 & 0.1063 & 0.1066 & 0.105 & 0.1056 & 0.0980 & 0.1056 & 0.1148 \\ 0.1409 & 0.1367 & 0.1421 & 0.14 & 0.1408 & 0.1306 & 0.1408 & 0.1435 \\ 0.1056 & 0.1063 & 0.1066 & 0.105 & 0.1056 & 0.0979 & 0.1056 & 0.1077 \\ 0.0845 & 0.0886 & 0.0853 & 0.084 & 0.0845 & 0.0784 & 0.0845 & 0.0538 \\ 0.0528 & 0.0532 & 0.0533 & 0.0525 & 0.0528 & 0.0490 & 0.0528 & 0.0538 \\ 0.1409 & 0.1367 & 0.1332 & 0.14 & 0.1408 & 0.2090 & 0.1408 & 0.1435 \end{bmatrix}$$

$$\text{arithmetic mean of row vectors} \begin{bmatrix} 0.2101 \\ 0.1584 \\ 0.1059 \\ 0.1394 \\ 0.1050 \\ 0.0805 \\ 0.0525 \\ 0.1481 \end{bmatrix} = W_1$$

The check process of consistency is as follows:

$$B_1 W_1 = \begin{bmatrix} 1 & 1.3333 & 2 & 1.5 & 2 & 2.5 & 4 & 1.5 \\ 0.75 & 1 & 1.5 & 1.1667 & 1.5 & 1.8 & 3 & 1.1667 \\ 0.5 & 0.6667 & 1 & 0.75 & 1 & 1.25 & 2 & 0.8 \\ 0.6667 & 0.8571 & 1.3333 & 1 & 1.3333 & 1.6667 & 2.6667 & 1 \\ 0.5 & 0.6667 & 1 & 0.75 & 1 & 1.25 & 2 & 0.75 \\ 0.4 & 0.5556 & 0.8 & 0.6 & 0.8 & 1 & 1.6 & 0.375 \\ 0.25 & 0.3333 & 0.5 & 0.375 & 0.5 & 0.625 & 1 & 0.375 \\ 0.6667 & 0.8571 & 1.25 & 1 & 1.3333 & 2.6667 & 2.6667 & 1 \end{bmatrix} \cdot \begin{bmatrix} 0.2101 \\ 0.1584 \\ 0.1059 \\ 0.1394 \\ 0.1050 \\ 0.0805 \\ 0.0525 \\ 0.1481 \end{bmatrix}$$

$$= \begin{bmatrix} 1.6857 \\ 1.2702 \\ 0.8503 \\ 1.187 \\ 0.8429 \\ 0.6444 \\ 0.4213 \\ 1.1904 \end{bmatrix} = \lambda_1 W_1$$

$$\lambda_1 = \frac{1}{8} \left( \frac{1.6857}{0.2101} + \frac{1.2702}{0.1584} + \frac{0.8503}{0.1059} + \frac{1.187}{0.1394} + \frac{0.8429}{0.1050} + \frac{0.6444}{0.0805} + \frac{0.4213}{0.0525} + \frac{1.1904}{0.1481} \right) = 8.0218$$

$$CI = \frac{\lambda_1 - n}{n-1} = \frac{8.0218 - 8}{8-1} = 0.0031$$

When  $n=8$ ,  $RI=1.41$ ,  $CR = \frac{CI}{RI} = \frac{0.0031}{1.41} = 0.0022 < 0.1$ , the consistency check is passed.

Therefore, according to the above calculation results, weights of factors of market strength are shown in Table 17 in Appendix 2.

③ Determination of weights of indicators of social culture strength

After discussion by 20 experts, the judgement matrix  $B_2$  of social culture strength is obtained, as is shown in Table 18 in Appendix 2.

The calculation process of weights is as follows:

$$B_2 = \begin{bmatrix} 1 & 5/3 & 2 \\ 3/5 & 1 & 6/5 \\ 1/2 & 5/6 & 1 \end{bmatrix} = \begin{bmatrix} 1 & 1.6667 & 2 \\ 0.6 & 1 & 1.2 \\ 0.5 & 0.8333 & 1 \end{bmatrix}$$

$$\text{normalization of column} \begin{bmatrix} 0.4762 & 0.4762 & 0.4762 \\ 0.2857 & 0.2857 & 0.2857 \\ 0.2381 & 0.2381 & 0.2381 \end{bmatrix}$$

$$\text{arithmetic mean of row vectors} \begin{bmatrix} 0.4762 \\ 0.2857 \\ 0.2381 \end{bmatrix} = W_2$$

The check process of consistency is as follows:

$$B_2 \cdot W_2 = \begin{bmatrix} 1 & 1.6667 & 2 \\ 0.6 & 1 & 1.2 \\ 0.5 & 0.8333 & 1 \end{bmatrix} \cdot \begin{bmatrix} 0.4762 \\ 0.2857 \\ 0.2381 \end{bmatrix} = \begin{bmatrix} 1.4286 \\ 0.8571 \\ 0.7143 \end{bmatrix} = \lambda_2 W_2$$

$$\lambda_2 = \frac{1}{3} \left( \frac{1.4286}{0.4762} + \frac{0.8571}{0.2857} + \frac{0.7143}{0.2381} \right) = 3$$

$$CI = \frac{\lambda - n}{n - 1} = \frac{3 - 3}{3 - 1} = 0$$

When  $n=3$ ,  $RI=0.58$ ,  $CR = \frac{CI}{RI} = 0 < 0.1$ , the consistency check is passed.

Therefore, weights of social culture strength are shown in Table 19 in Appendix 2.

④ Determination of weights of indicators of consumer strength

After discussion by 20 experts, the judgement matrix  $B_3$  of consumer strength is obtained, as is shown in Table 20 in Appendix 2.

The calculation process of weights is as follows:

$$B_3 = \begin{bmatrix} 1 & 3/2 \\ 2/3 & 1 \end{bmatrix} = \begin{bmatrix} 1 & 1.5 \\ 0.6667 & 1 \end{bmatrix}$$

$$\text{normalization of column} \begin{bmatrix} 0.6 & 0.6 \\ 0.4 & 0.4 \end{bmatrix} \text{arithmetic mean of row vectors} \begin{bmatrix} 0.6 \\ 0.4 \end{bmatrix} = W_3$$

The check process of consistency is as follows:

$$B_3 \cdot W_3 = \begin{bmatrix} 1 & 1.5 \\ 0.6667 & 1 \end{bmatrix} \cdot \begin{bmatrix} 0.6 \\ 0.4 \end{bmatrix} = \begin{bmatrix} 1.2 \\ 0.8 \end{bmatrix} = \lambda_3 W_3$$

$$\lambda_3 = \frac{1}{2} \left( \frac{1.2}{0.6} + \frac{0.8}{0.4} \right) = 2$$

$$CI = \frac{\lambda - n}{n - 1} = \frac{2 - 2}{2 - 1} = 0$$

$$CR = \frac{CI}{RI} = 0 < 0.1, \text{ the consistency check is passed.}$$

Therefore, according to the above calculation results, weights of consumer strength are shown in Table 21 in Appendix 2.

According to all the above calculation results, the preliminary weights of all factors of the brand strength of Y Company can be obtained, as is shown in Table 6-9.

Table 6-9 Weights of all factors of the brand strength of Y Company

Dimension $U_i$	Weight $W_i$	Indicator $U_{ij}$	Weights of all factors $W_{ij}$
Market Strength $U_1$	$W_1 0.6232$	Leadership $U_{11}$	0.2101
		Stability $U_{12}$	0.1584
		Market Power $U_{13}$	0.1059
		International Power $U_{14}$	0.1394
		Trend Power $U_{15}$	0.1050
		Supporting Capacity $U_{16}$	0.0805
		Protective Capacity $U_{17}$	0.0525
		Innovation Capacity $U_{18}$	0.1481
Social Culture Strength $U_2$	$W_2 0.1373$	Enterprise Credit $U_{21}$	0.4762
		Social Responsibility $U_{22}$	0.2857
		Enterprise Culture $U_{23}$	0.2381
Consumer Strength $U_3$	$W_3 0.2395$	Consumer Attitude $U_{31}$	0.6
		Consumer Behavior $U_{32}$	0.4

### (3) Fuzzy evaluation of evaluation indicators of brand strength

#### ① Fuzzy evaluation of indicators of market strength

The set of evaluation factors of market strength  $U_1 = (U_{11}, U_{12}, U_{13}, U_{14}, U_{15}, U_{16}, U_{17}, U_{18}) = (\text{leadership, stability, market power, international power, trend power, supporting capacity, protective capacity, innovation capacity})$ ;

Establishing the evaluation set  $V = (V_1, V_2, V_3, V_4, V_5) = (\text{good, relatively good, average, relatively poor, poor})$ ;

relatively bad, bad), and quantifying factors in the judgement set:  $V_1=95$ ,  $V_2=80$ ,  $V_3=65$ ,  $V_4=50$ ,  $V_5=35$ .

Targeted at the influencing factors of the brand strength of Y Company, the method of questionnaire survey is adopted to its comprehensive evaluation. A total of 250 questionnaires were distributed and 205 copies were retrieved, 193 of which were valid enough to be used to analyze the influencing factors of the brand strength of Y Company. As is shown in Table 22 in Appendix 2.

### ② Fuzzy evaluation of indicators of social culture strength

The set of evaluation factors of social culture strength  $U_2 = (U_{21}, U_{22}, U_{23}) = (\text{enterprise credit, social responsibility, enterprise culture})$ ; the evaluation set  $V = (V_1, V_2, V_3, V_4, V_5) = (\text{good, relatively good, average, relatively bad, bad})$ .

Based on the respondents' evaluation of the three factors of social culture strength, a comprehensive evaluation table of social culture strength can be obtained, as is shown in Table 23 in Appendix 2.

### ③ Fuzzy evaluation of indicators of consumer strength

The set of evaluation factors of consumer strength  $U_3 = (U_{31}, U_{32}) = (\text{consumer attitude, consumer behavior})$ ; the evaluation set  $V = (V_1, V_2, V_3, V_4, V_5) = (\text{good, relatively good, average, relatively bad, bad})$ .

Based on the respondents' evaluation of the two consumer-related factors, the comprehensive evaluation table of the consumer strength can be obtained, as is shown in Table 24 in Appendix 2.

### (4) Determination of the fuzzy relation matrix of the factor layer

Based on the above results, the evaluation indicator system of the market strength of Y Company can be obtained, as is shown in Table 6-10.

### ① Fuzzy comprehensive evaluation of factors of market strength

As  $W_1 = [0.2101 \quad 0.1584 \quad 0.1059 \quad 0.1394 \quad 0.1050 \quad 0.0805 \quad 0.0525 \quad 0.1481]$

the comment set vectors of market strength can be figured out:

$$B_1 = W_1 U_1 = \begin{bmatrix} 0.2101 \\ 0.1584 \\ 0.1059 \\ 0.1394 \\ 0.1050 \\ 0.0805 \\ 0.0525 \\ 0.1481 \end{bmatrix}^T \begin{bmatrix} 0.2228 & 0.5803 & 0.1813 & 0.0155 & 0 \\ 0.3212 & 0.5492 & 0.1088 & 0.0207 & 0 \\ 0.2953 & 0.4819 & 0.1813 & 0.0363 & 0.0052 \\ 0.1969 & 0.5389 & 0.2124 & 0.0415 & 0.0104 \\ 0.1813 & 0.5129 & 0.2435 & 0.057 & 0.0052 \\ 0.1451 & 0.6062 & 0.1865 & 0.0622 & 0.0104 \\ 0.1762 & 0.5699 & 0.2228 & 0.0311 & 0 \\ 0.1503 & 0.5078 & 0.2591 & 0.0725 & 0.0104 \end{bmatrix}$$

$$= [0.2187 \quad 0.5427 \quad 0.1948 \quad 0.0375 \quad 0.0049]$$

Table 6-10 Evaluation indicator system of the brand strength of the Y Company

Dimension	Indicator	Proportion of Each Indicator				
		Good	Relatively good	Average	Relatively Bad	Bad
Market Strength	Leadership	0.2228	0.5803	0.1813	0.0155	0
	Stability	0.3212	0.5492	0.1088	0.0207	0
	Market Power	0.2953	0.4819	0.1813	0.0363	0.0052
	International Power	0.1969	0.5389	0.2124	0.0415	0.0104
	Trend Power	0.1813	0.5129	0.2435	0.057	0.0052
	Supporting Capacity	0.1451	0.6062	0.1865	0.0622	0.0104
	Protective Capacity	0.1762	0.5699	0.2228	0.0311	0
	Innovation Capacity	0.1503	0.5078	0.2591	0.0725	0.0104
Social Culture Strength	Enterprise Credit	0.2642	0.5181	0.2021	0.0155	0
	Social Responsibility	0.2021	0.5544	0.2176	0.0259	0
	Enterprise Culture	0.1813	0.4819	0.2902	0.0363	0.0104
Consumer Strength	Consumer Attitude	0.3264	0.5285	0.1244	0.0207	0
	Consumer Behavior	0.2383	0.4974	0.2124	0.0415	0.0104

② Fuzzy comprehensive evaluation of factors of social culture strength

As  $W_2 = [0.4762 \quad 0.2857 \quad 0.2381]$ , the comment set vectors of social culture strength can be figured out:

$$B_2 = W_2 U_2 = \begin{bmatrix} 0.4762 \\ 0.2857 \\ 0.2381 \end{bmatrix}^T \begin{bmatrix} 0.2642 & 0.5181 & 0.2021 & 0.0155 & 0 \\ 0.2021 & 0.5544 & 0.2176 & 0.0259 & 0 \\ 0.1813 & 0.4819 & 0.2902 & 0.0363 & 0.0104 \end{bmatrix}$$

$$= [0.2267 \quad 0.5199 \quad 0.2275 \quad 0.0234 \quad 0.0025]$$

③ Fuzzy comprehensive evaluation of factors of consumer strength

As  $W_3 = (0.6, 0.4)$ , the comment set vectors of consumer strength can be figured out:



$$B_3 = W_3 U_3 = \begin{bmatrix} 0.6 \\ 0.4 \end{bmatrix}^T \begin{bmatrix} 0.3264 & 0.5285 & 0.1244 & 0.0207 & 0 \\ 0.2383 & 0.4974 & 0.2124 & 0.0415 & 0.0104 \end{bmatrix}$$

$$= [0.2912 \quad 0.5161 \quad 0.1596 \quad 0.029 \quad 0.0042]$$

(5) Determination of the fuzzy relation matrix of the target layer

According to the above calculation, the evaluation vectors under three strengths are obtained. Now, using  $B_1, B_2, B_3$  to get the membership matrix  $U$  of the brand strength  $U$ :

$$U = \begin{bmatrix} 0.2187 & 0.5427 & 0.1948 & 0.0375 & 0.0049 \\ 0.2267 & 0.5199 & 0.2275 & 0.0234 & 0.0025 \\ 0.2912 & 0.5161 & 0.1596 & 0.029 & 0.0104 \end{bmatrix}$$

Combining the above AHP to obtain the weighted vectors of the brand strength  $U$

$W = [0.6232 \quad 0.1373 \quad 0.2395]$ , the evaluation set vectors of the brand strength  $U$  are obtained:

$$B = WU = \begin{bmatrix} 0.6232 \\ 0.1373 \\ 0.2395 \end{bmatrix}^T \begin{bmatrix} 0.2187 & 0.5427 & 0.1948 & 0.0375 & 0.0049 \\ 0.2267 & 0.5199 & 0.2275 & 0.0234 & 0.0025 \\ 0.2912 & 0.5161 & 0.1596 & 0.029 & 0.0104 \end{bmatrix}$$

$$= [0.2371 \quad 0.5332 \quad 0.1908 \quad 0.0335 \quad 0.0059]$$

(6) Determination of the comprehensive score of the target strength

According to the quantified grades of factors in the evaluation set  $V = (V_1, V_2, V_3, V_4, V_5)$ ,  $V_1=95, V_2=80, V_3=65, V_4=50, V_5=35$ , the brand strength  $I$  of Y Company is obtained:

$$I = BV = \begin{bmatrix} 0.2371 \\ 0.5332 \\ 0.1908 \\ 0.0335 \\ 0.0059 \end{bmatrix}^T \begin{bmatrix} 95 \\ 80 \\ 65 \\ 50 \\ 35 \end{bmatrix} = 79.464$$

### 6.3.5 Calculation of the brand value of Y Company

According to the Formula 3.1, the multiple and score of brand strength is:

$$\begin{cases} 250y = x^2 & x \in [0, 50] \\ (y-10)^2 = 2x-100 & x \in (50, 100] \end{cases}$$

When the score of brand strength is 79.464 and the multiple of brand strength is 17.68.

According to Formula 4.1, brand value = earnings of brand  $\times$  multiple of brand, so the brand value of Y Company can be figured out:

$$V = 1,073,920,571.44 \times 17.68 = 18,986,915,703.06 \text{ yuan RMB}$$

## **6.4 Brief summary**

This chapter is mainly about the actual case application of the model improved in this study. This study takes Y Company of China as an example, and calculates the brand value process of Y Company in detail.

## Chapter 7: Analysis of Evaluation Results

On the basis of analyzing the influencing mechanism of brand value evaluation in China's pharmaceutical industry, this thesis improves the Interbrand model and constructs a brand value model that is suitable for China's pharmaceutical industry and applies this model to Y Company, which draws a conclusion that the brand value of Y Company is 18.987 billion RMB. This evaluation result is significantly different from the brand value evaluated by Interbrand as 7.8 billion RMB. But it is very close to the one evaluated by Beijing Brand Asset Evaluation Co., Ltd as 19.56 billion RMB and the one released by World Brand Lab as 23.3 billion RMB.

### 7.1 Analysis of rationality of evaluation results

In evaluating the brand value of Y Company, this thesis does not only aim at obtaining a final result because an absolute figure cannot prove whether this evaluation method is systematic, which should to be tested by comparing results of this evaluation method with those obtained through other methods. As is shown in Table 7-1.

Table 7-1 Comparison of brand value evaluation of Y Company in 2018 evaluated by evaluation agencies from China and other countries

No.	Evaluation Agencies	Brand Value of Y Company
1	Interbrand	7.937 billion RMB
2	World Brand Lab	23.329 billion RMB
3	Beijing Brand Asset Evaluation Co., Ltd.	19.56 billion RMB
4	This Research	18.987 billion RMB

### 7.2 Analysis of difference of evaluation results

The evaluation results of Y Company's brand value obtained by using China's pharmaceutical industry's brand value model established in this thesis are different from the results of Interbrand. The reasons behind this may include the difference in evaluation model,

brand value concept, and features of the evaluation agencies, which are shown in Table 7-2.

Table 7-2 Comparison of brand value evaluation of Y Company in 2018 analyzed by evaluation agencies from China and other countries

Evaluation Agencies	Evaluation Indicators	Limitation
Interbrand	Financial income, brand value index, and brand strength	Neglecting consumer factor
World Brand Lab	Market share, index of brand value added, and brand strength	Incomplete risk prediction of future income
Beijing Brand Asset Evaluation Co., Ltd.	Brand's market share, brand's super-value profit-making capability, and brand development potential	Lacking "third party" independent financial data
This Research	Financial income, brand function index, brand strength	Limitation on data acquisition

(1) There has not been a standard or consensus reached by the academic community and practice communities on the confirmation of rationality of the evaluation results. In the case study of loyalty factor method, Fan and Leng (2000) pointed out that the difference between the evaluation results of the same brand based on different methods generally ranged from 30% to 50%. Compared with the evaluation results of World Brand Lab, therefore, the evaluation results of this research are acceptable.

(2) The evaluation method of Beijing Brand Asset Evaluation Co., Ltd. involves industrial difference and its evaluation results are very close to the ones of this research, which are nearly the same.

(3) The evaluation results of this research are significantly different from those of Interbrand and the brand value of Y Company evaluated by this research is two times as high as the one evaluated by Interbrand. The main reasons are shown as follows:

① The calculating methods of brand function index are different. The previous Interbrand model uses the experts grading method to calculate the brand function index, which is prone to be interfered by subjective factors. This thesis introduces the analytic hierarchy process (AHP) and combines qualitative and quantitative methods to analyze the brand function index, avoiding the subjectivity to the greatest extent and raising the accuracy and objectivity of the evaluation.

② The evaluating factors of brand strength are different. Extending the seven factors of previous Interbrand model, this thesis selects 13 evaluating indicators of financial, market and social factors, which fully reflect the brand strength.

③ The calculating methods of brand strength are different. The previous Interbrand model conducts the analysis based on seven factors and sets up the highest score of each factor and grades these seven factors through the experts grading method. And finally the brand strength is obtained by adding the seven scores. However, this thesis calculates the brand strength through AHP and fuzzy comprehensive evaluation mathematical method, which is more reasonable.

④ The survey groups are different. As a British evaluation company, the Interbrand is in lack of China's local cognition in its evaluation of the Chinese company Y Company. But this thesis collects data by combining the survey of Chinese local consumers, which exerts certain effect on the evaluation results.

As a result, the evaluation method of this thesis, which is based on the improved Interbrand model, is slightly better than those of Interbrand, World Brand Lab, and Beijing Brand Asset Evaluation Co., Ltd. in terms of operability and transparency, providing certain reference for the practical studies of the brand value evaluation in China's pharmaceutical industry.

### **7.3 Extended analysis of evaluation results**

Featuring with marketability and expansibility, the development of brand value evaluation will change along with the emergence of new technologies, new cultures, new concepts, new marketing, and new sectors. This thesis uses the improved Interbrand evaluation method to evaluate the brand value of Y Company and conducts a contrastive analysis on the evaluation results with those of other evaluation agencies, aiming at testifying the scientificity, applicability, and practicability of the improved Interbrand evaluation method, so as to provide a reference for more people to improve and remedy this method. At the same time, we also hope to establish a brand value evaluation method that is suitable for the pharmaceutical industry.

Brand value is a reflection of the socialization of enterprise value. For the pharmaceutical industry, a stronger pharmaceutical enterprise requires the right guidance and

implementation of brand strategies. As a result, the evaluation methods of brand value in the pharmaceutical industry need to be constantly improved and applied to practice. Evaluation agencies should continuously absorb the latest theories and research methods of brand asset value, deeply explore the connotation of brand asset value, optimize evaluation indicators and evaluation detailed rules as well as regulations, and ceaselessly improve the evaluation methods to evaluate the brand value in a more reasonable and reliable manner. Only in this way can they constantly optimize the evaluation methods of brand asset value, raise their social status and influence, attract pharmaceutical enterprises' attention on brand asset, and transit enterprises' value information through brands so as to promote the correct and effective implementation of enterprises' brand strategies.

#### **7.4 Brief summary**

This chapter mainly analyses the calculation results of Y Company's brand value. Because the evaluation indexes of different evaluation subjects are different, the evaluation results of the model designed in this study are different from those published by Interbrand Company, Beijing Brand Asset Assessment Company and World Brand Laboratory. The rationality and difference of the results are analyzed in this chapter.

## Chapter 8: Research Conclusions and Prospects

### 8.1 Research conclusions

By teasing out relevant theories of brand value and brand value evaluation methods and based on the analysis of the influencing mechanisms of enterprise brand value as well as combining the features of China's pharmaceutical industry, this thesis improves the previous Interbrand model, constructs a brand value model of China's pharmaceutical industry, conducts a case study of Y Company, and analyzes the rationality and difference of the evaluation results. The main research conclusions of this thesis are shown as follows:

(1) Consumers are the key factors in realizing the brand value.

Brand value is the added value brought by the intangible asset of brands for enterprise owners and consumers. As a result of the interaction between enterprises and consumers, the brand value, on one hand, is sourced from enterprises' efforts in acquiring and managing brands, and on the other hand, comes from consumers' cognition, reliance, and loyalty to brands. The precondition of systematically evaluating China's pharmaceutical industry's value is to deeply analyze pharmaceutical enterprises' connotation, features, and value sources from the essence of the industry. Only through an in-depth analysis of the evaluated objects can we explore their potential value in a targeted manner. Therefore, this thesis theoretically believes that the market-based evaluation methods should be integrated with the consumer-based ones to construct a new method for evaluating the brand value.

(2) The comprehensive brand strength indicator system is more convincing.

The formation of brand value is undoubtedly the organic integration of finance, markets, consumers, and social culture. The evaluation of brand value should take into full consideration of these factors, without any factor being left behind. After conducting a contrastive analysis of various brand value evaluation methods, this thesis improves the previous Interbrand model and preliminarily constructs an evaluation system of brand value of China's pharmaceutical industry, which is composed of three parts: market strength, consumer strength, and social cultural strength. The factors considered in this thesis's model are more comprehensive than those in the Interbrand evaluation method. Therefore, compared

with those of Interbrand evaluation method, the evaluation results in this thesis are more accurate.

(3) The AHP and fuzzy comprehensive evaluation mathematical method are adopted to determine the model's parameters, which is more objective and operative.

China's brand value evaluation research and practice remain at the exploration stage, and the construction of China's expert teams and databases lags far behind that of other countries. In order to reduce the influence of subjective factors on the evaluation results, in the analysis of brand strength, this thesis uses AHP to compare the proportion of brand strength's influencing factors. Meanwhile, relevant knowledge of fuzzy mathematics is also used to calculate the value of brand strength and reduce subjective factors' negative influence on the evaluation results. The qualitative analysis is combined with the quantitative one to construct a systematic brand value evaluation system that is suitable for China's pharmaceutical industry.

(4) This research is based on Y Company, which is of high research value.

This thesis applies the improved brand value model to Y Company, concluding that the brand value of Y Company is about 18.987 billion RMB. Compared with the evaluation result of Interbrand, there have been some differences but they remain reasonable. Meanwhile, this thesis concludes that the main reasons for the difference are the different brand function index, brand strength, and questionnaires. This thesis applies the improved Interbrand model to the brand value evaluation of Y Company, explores the real factors that influence the brand value, and guides pharmaceutical enterprises to carry out systematic brand management so as to raise the brand value and strengthen the brand market competitiveness of China's pharmaceutical industry.

## **8.2 Suggestions for increasing the brand value of China's pharmaceutical industry**

Instead of quantifying the brand value, the significance of exploring the proper brand value evaluation methods lies in analyzing the brands' advantages and disadvantages through evaluation procedures, guiding enterprises to further improve their disadvantages and strengthen their advantages, creating powerful brands, raising the brands' competitiveness, and creating greater benefits for enterprises. This thesis's research results, to certain extent,



can provide relevant suggestions for the brand value evaluation of China's pharmaceutical industry as well as offer some reference for the development and growth of this industry. According to the changes of brand value, pharmaceutical enterprises' brand managers can timely adjust the enterprises' brand management strategies to preserve and increase the brand value. There are some suggestions for raising the brand value of China's pharmaceutical industry listed as follows.

(1) Attach importance on quality of pharmaceutical and medical products

According to the analytic hierarchy model of incomes of brands' intangible assets, the quality advantage accounts for 59.48%, this is obviously higher than the proportions of other factors. As the product quality is the most important standard for medical products, pharmaceutical enterprises should improve the quality management capability and strengthen quality management system construction during their production process. They should stick to the principle of quality first and constantly improve the quality development mode of "improving the quality of whole industry chain, comprehensively reshaping brands, all staff participation in value innovation, and managing and controlling overall-process quality and safety". Greater efforts should be made to strengthen quality supervision and put an end to the sales of defective products so that consumers trust the brands, which could guarantee that the good and professional market brands can be realized eventually.

(2) Strengthen consumption experience and raise the brand popularity and loyalty

Consumers play a key role in the development of pharmaceutical enterprises. Brands can bring excess earnings for enterprises only if they are accepted and consumed by consumers. On the basis of ensuring product quality, pharmaceutical enterprises should be good at taking advantage of such strategies as brand spokespersons and advertisement marketing to highlight the core advantages of their products and raise the popularity of their brands in China. As the brand loyalty is usually based on consumers' long-term reliance, when necessary, consumers are willing to re-purchase and recommend the products of the brands they trust. Two important influencing factors in building brand loyalty are quality and services. On the basis of ensuring product quality, an excellent service contributes to cultivating consumers' affection, which can be transformed into brand loyalty.

(3) Enhance brand management

① Pharmaceutical enterprises should innovate their brands to adapt themselves to the market and meet the personalized demands. The fierce competition in the pharmaceutical

industry requires pharmaceutical enterprises to explore potential business opportunities and innovate their brands.

② Construct an all-round brand cultivation system. Pharmaceutical enterprises should adhere to the customer-oriented service philosophy, constantly refine and develop their brand potential and connotation, and transform the brands from a single medical filed into well-known massive health brands that are widely accepted by the market and consumers.

③ Advocate public welfare establishments. Enterprises' support for public welfare establishments is beneficial to undertaking social responsibilities and building positive enterprise images. The enterprises with better development should bear greater responsibilities. Pharmaceutical enterprises' greater support for public welfare establishments will increase their brand value.

#### (4) Strengthen innovation and reform

Pharmaceutical enterprises need to apply the innovative philosophies and practice to all aspects of production, operation, and management, as well as having a new try on and raising advantages of such sectors as technological project initiation, new product R&D, exploring potentials of existing products, brand marketing, and service support and security, so as to lay a solid foundation for the enterprise development. By integrating and allocating resources, constructing platforms, and proactively exploring poly-type and diversified commercial modes, in addition, pharmaceutical enterprises should establish all-round and tridimensional marketing channel systems and optimize as well as upgrading their market expansion capability and brands.

### **8.3 Future research prospects**

Selecting Y Company as the object of brand value evaluation, this thesis is preliminarily trying to study the brand value evaluation of China's pharmaceutical industry. During the whole research process, there are many deficiencies to be further studied and improved.

(1) There are limitations on the sample selection of questionnaire, which require to be improved. In terms of questionnaire sample selection, we mainly select relevant administrators and consumers in Guangdong and Yunnan. Therefore, the research results are interfered and affected by regional locations. Restricted by time, cost, and other factors, the questionnaires are mainly distributed in the above five regions, indicating a relatively small distribution

scope, which fails to reflect the overall market conditions in China's pharmaceutical industry. The research conclusions mainly reflect the data collected in this survey and it is uncertain whether they are applicable to other regions. Through this research, we only hope to provide some suggestions for the brand management of China's pharmaceutical enterprises.

(2) Construct a more comprehensive brand value evaluation indicator system that covers a broader range. In the evaluation of brand strength, this thesis introduces the perspective of social culture and conducts evaluation from the perspectives of enterprise credit, social responsibility, and enterprise culture. However, the author believes that the evaluation of these factors should be further improved and more factors, such as energy saving and environmental protection as well as reduction in energy consumption, should be added in the future. The pharmaceutical industry, whose development is a dynamic process, should make constant innovation and keep pace with the times during its development process and ceaselessly integrate and refine the historical precipitation of social culture to inject new connotation and generate new vitality. As the brand value evaluation of pharmaceutical industry is a systematic, complicated, and comprehensive task, such an evaluation should be based on the perspective of dynamic development. In addition, further studies should be conducted to figure out whether there are other influencing factors in consumer strength, except for consumer attitude and consumer behavior.

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### Appendix 1: Related Figures

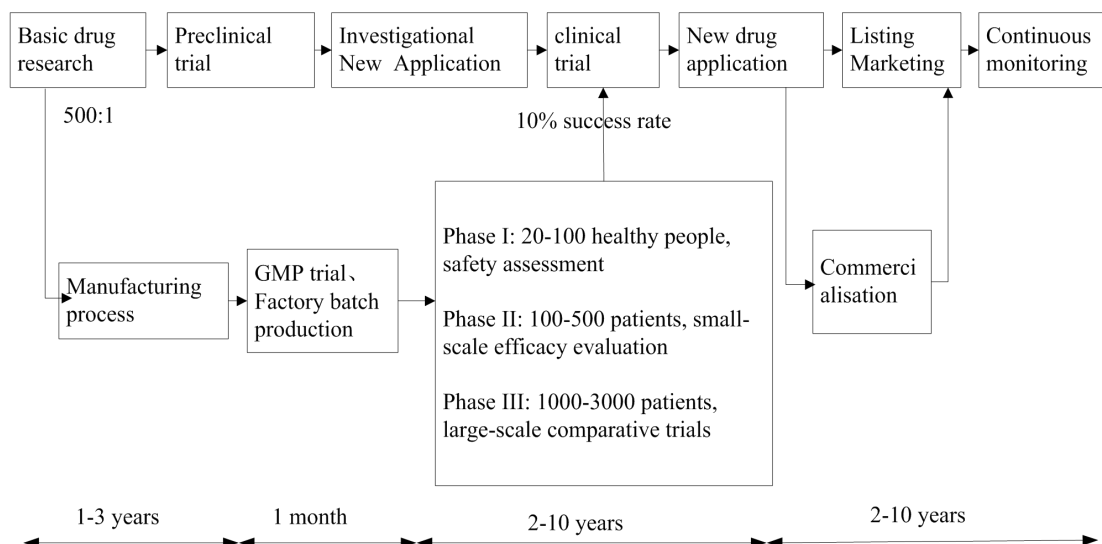


Figure 1 Drug R&D and listing process

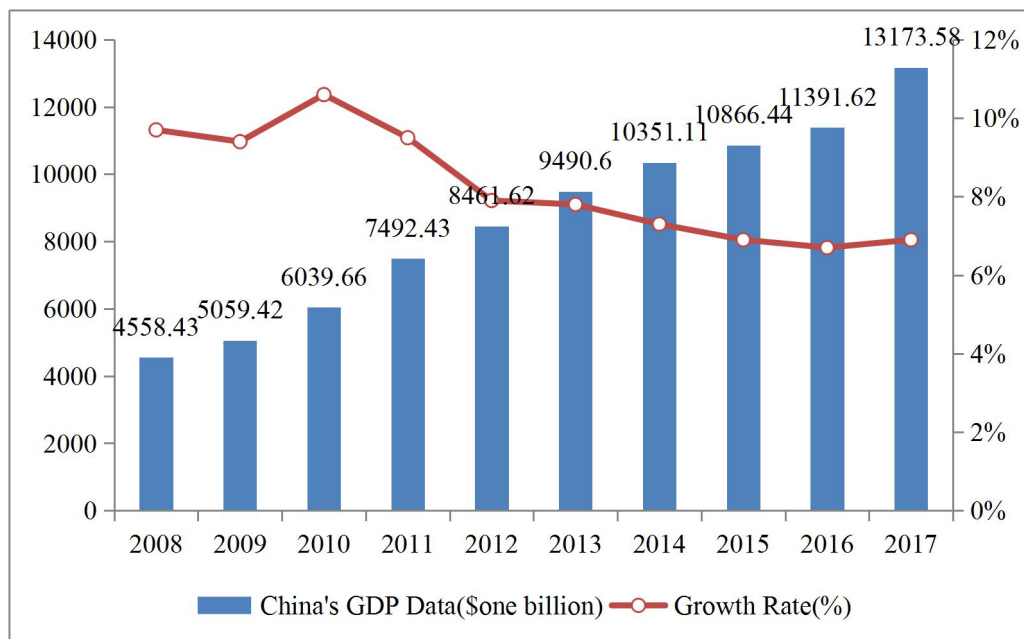


Figure 2 China's GDP data in recent ten years

Source: World Economic Information Network (2018)

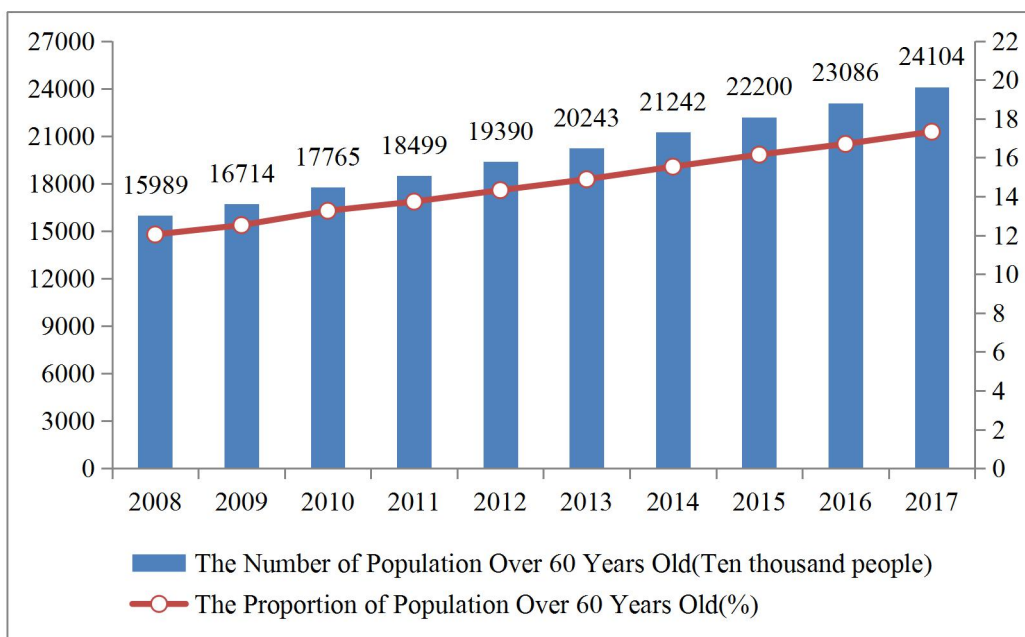


Figure 3 The number and proportion of population over 60 years old in China

Source: Press Conference of released by Office of the National Commission on Aging (2018)

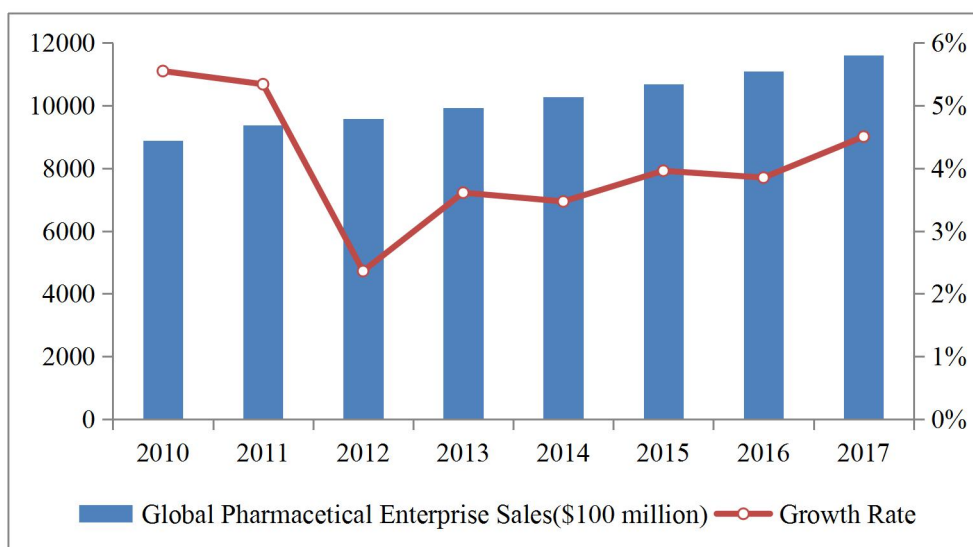


Figure 4 Global pharmaceutical enterprise sales and growth rate

Source: IMS Prospective Industry Research Institute (2018)



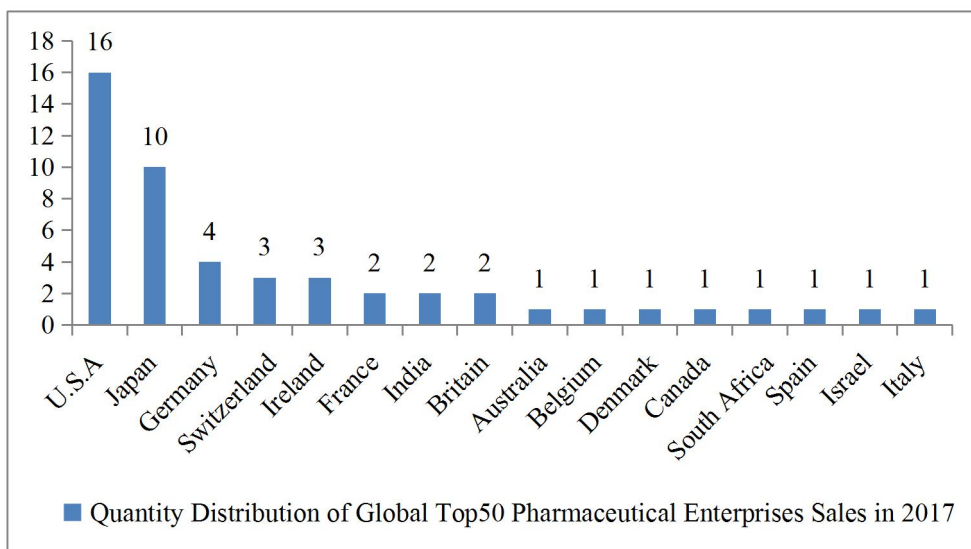


Figure 5 Quantity distribution of global Top50 pharmaceutical enterprises sales in 2017

Source: IMS Prospective Industry Research Institute (2018)

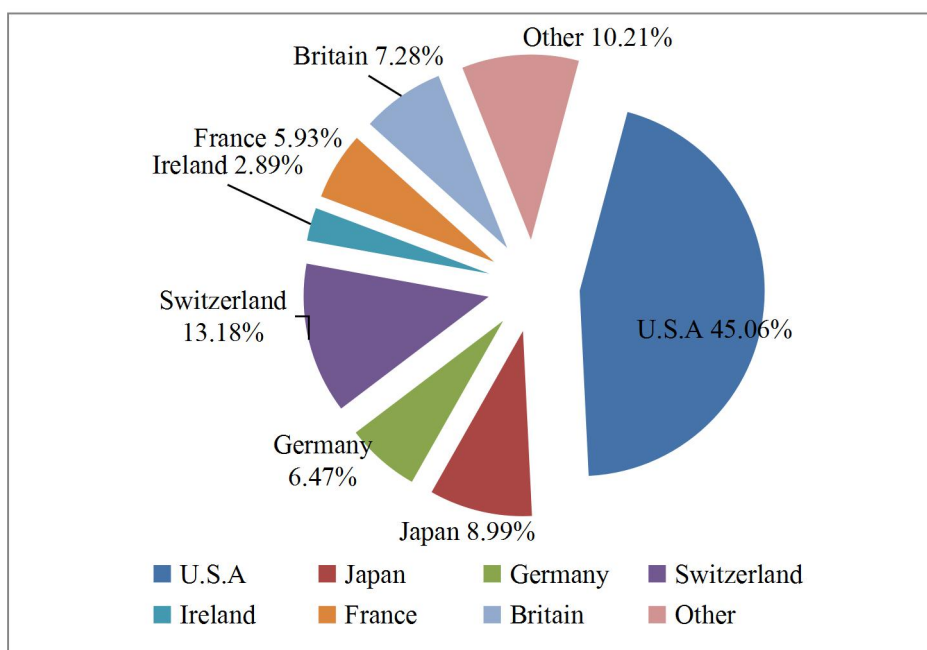


Figure 6 Proportion of national sales of global top50 pharmaceutical enterprises in 2017

Source: IMS Prospective Industry Research Institute (2018)

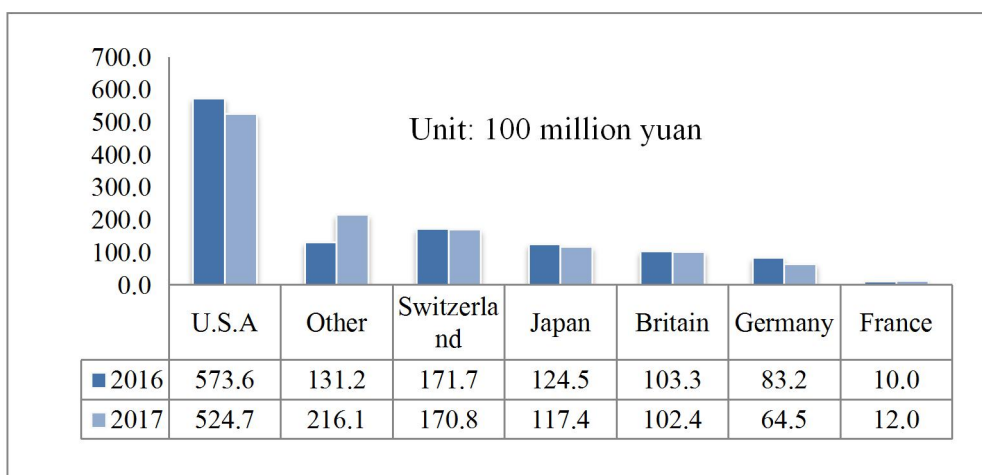


Figure 7 R&D investment of top50 global pharmaceutical enterprises in 2016-2017

Source: IMS Prospective Industry Research Institute (2018)

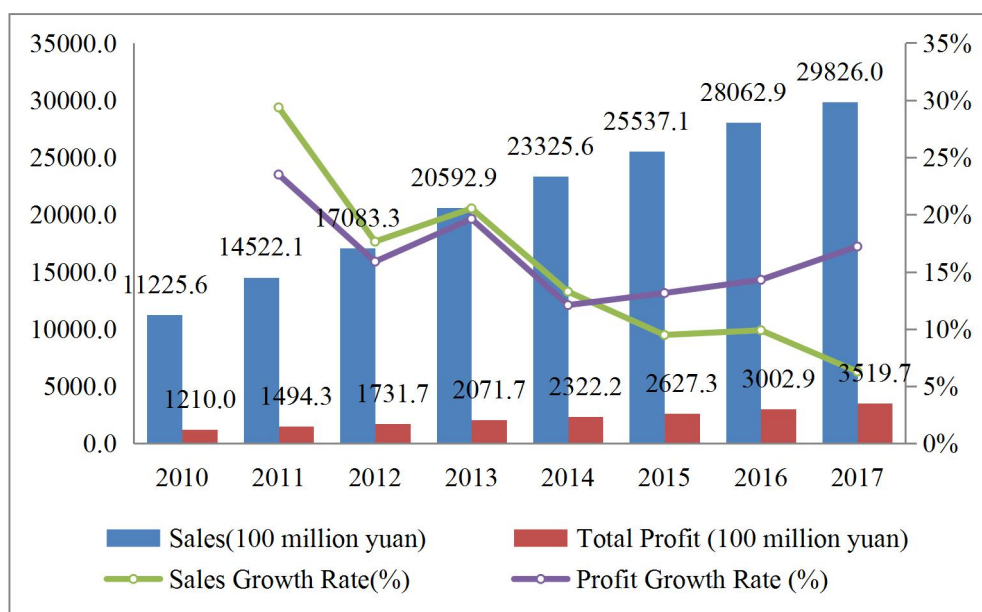


Figure 8 China's pharmaceutical enterprises total sales revenue and profits

Source: IMS Prospective Industry Research Institute (2018)

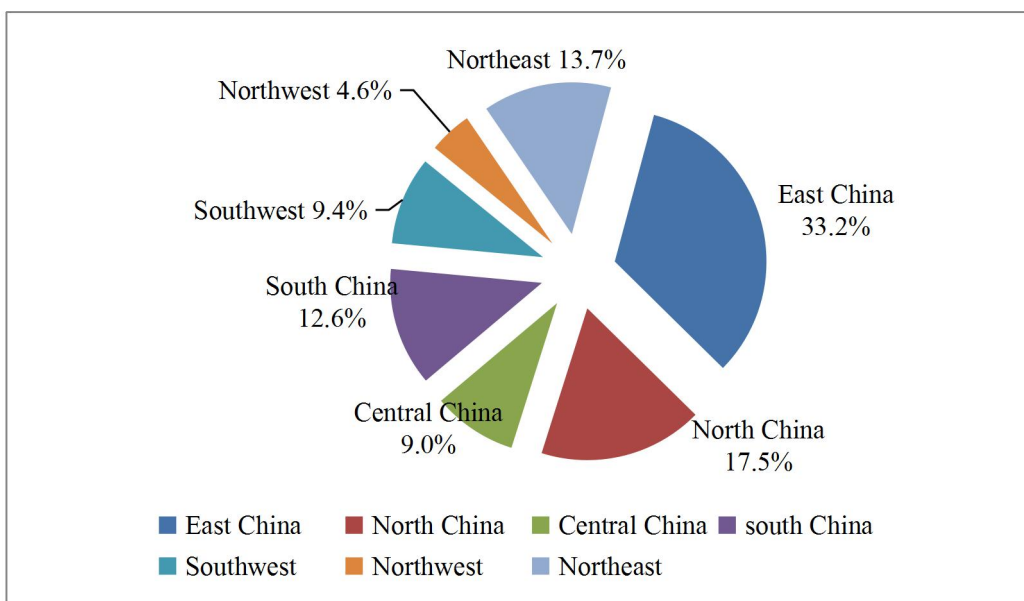


Figure 9 China's pharmaceutical enterprises market share in 2017

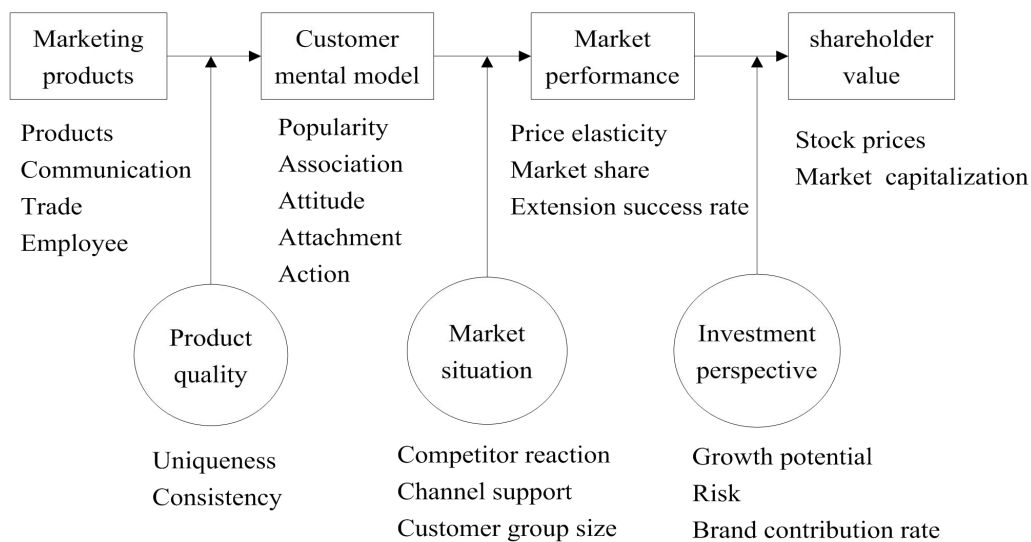


Figure 10 Brand value chain

Source: Keller (2003)

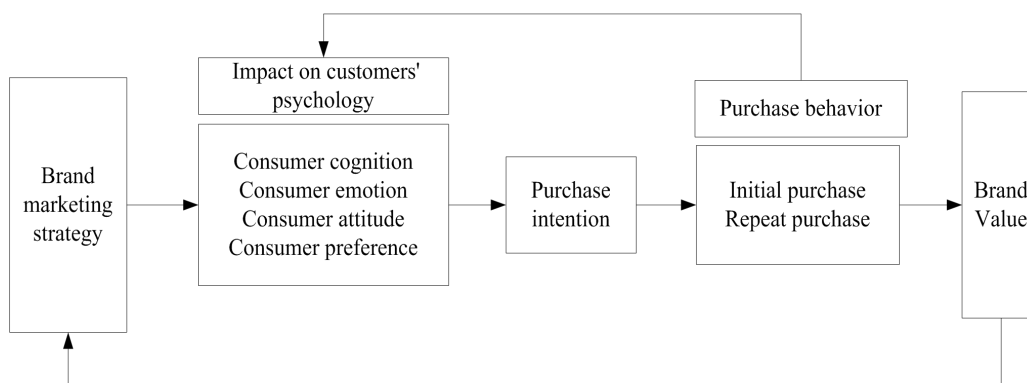


Figure 11 Brand action mechanism model

Source: Fan (2000)

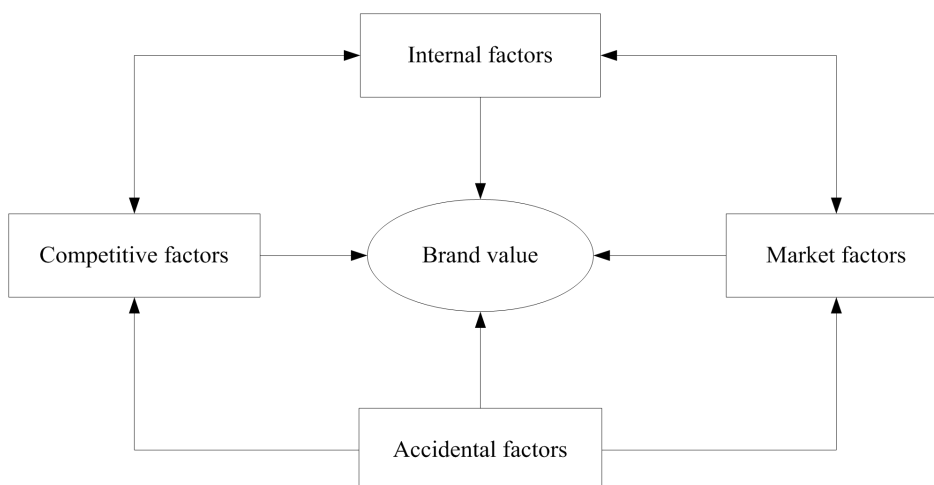


Figure 12 Brand value fluctuation model

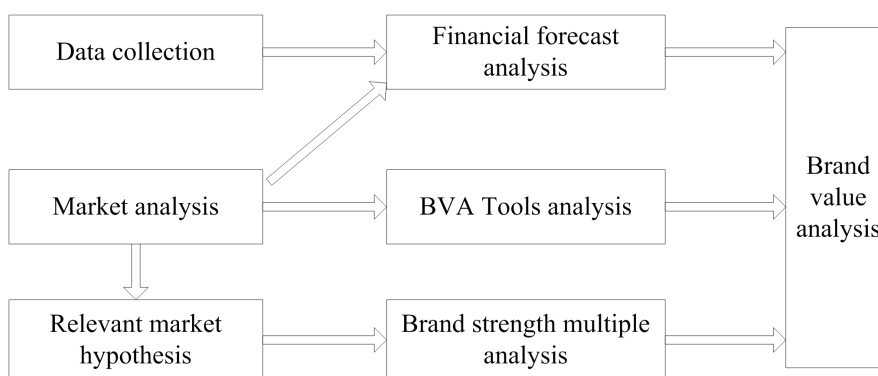


Figure 13 The analysis process of brand value by WBL model

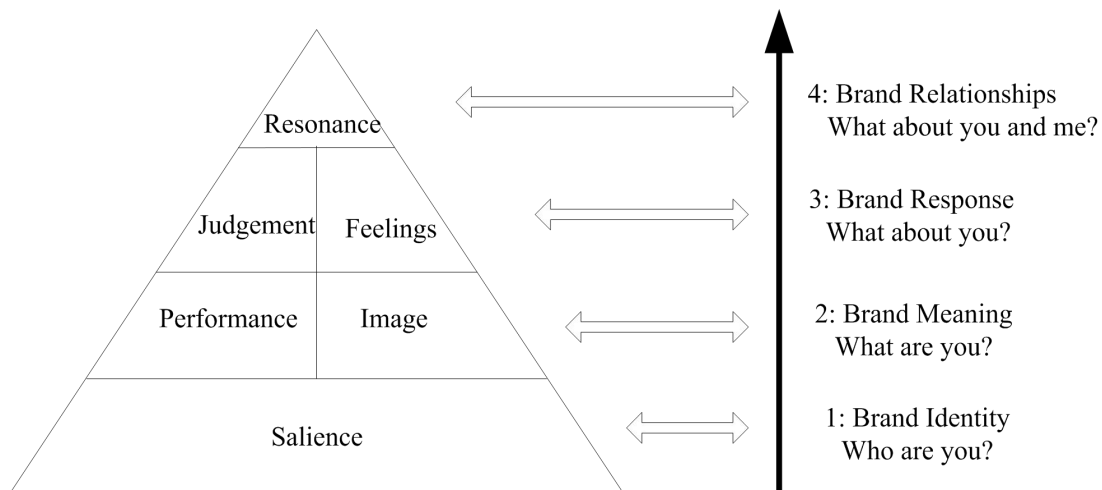


Figure 14 CBBE brand equity assessment model

Source: Keller (2001)

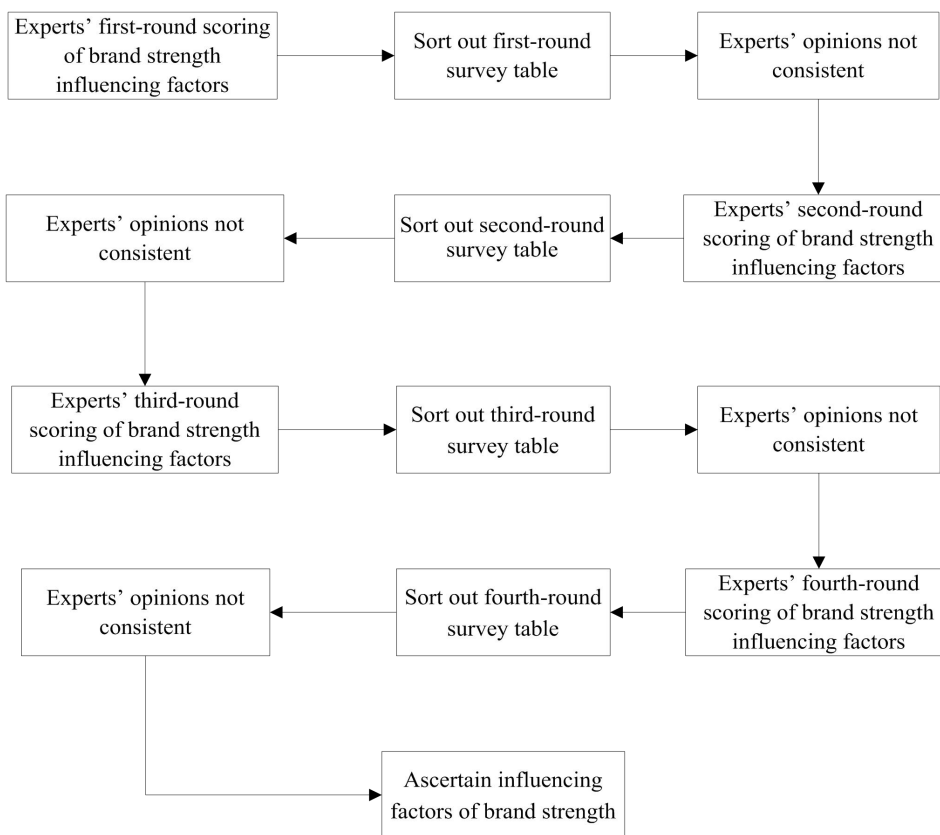


Figure 15 Procedures of the delphi method applied in the project

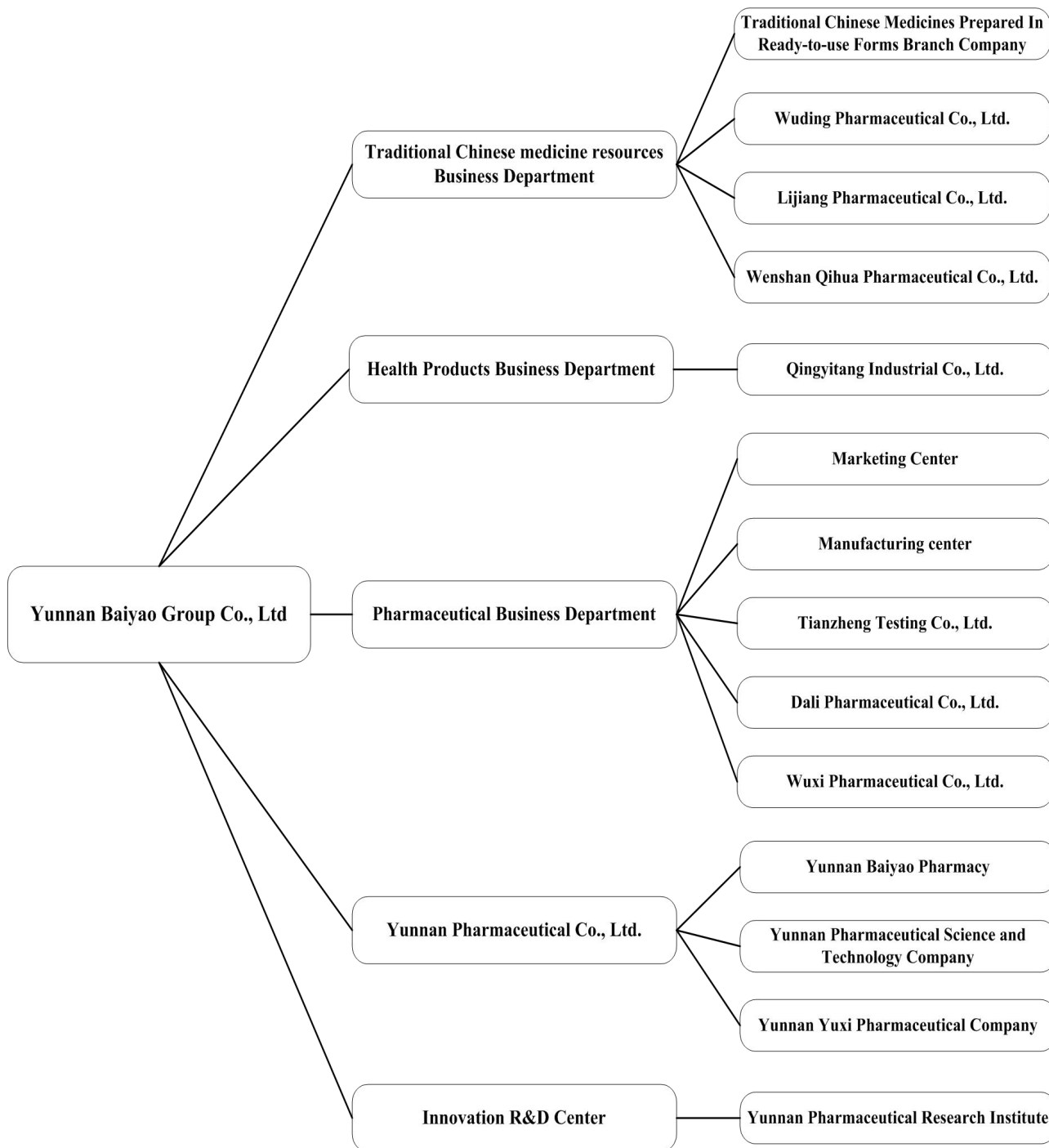


Figure 16 Y Company organization structure

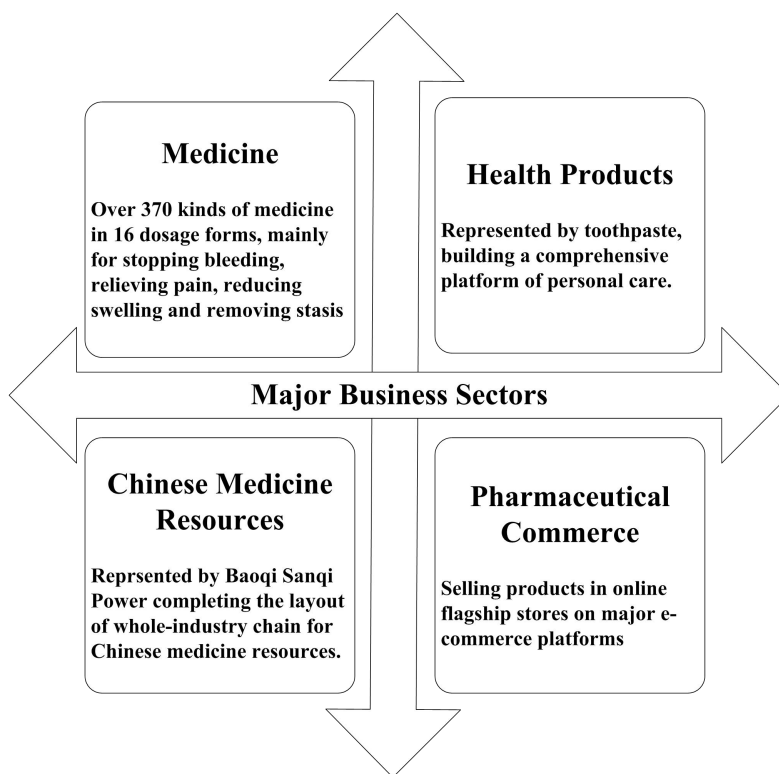


Figure 17 Business sectors

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## Appendix 2: Related Tables

Table 1 Top 10 global R&D investment enterprises in 2017

Rank	Company	Country	Industry	R&D Expenditure (€ bn)	R&D ratio
1	VOLKSWAGEN	Germany	Automobile and parts	13.7	6.3%
2	ALPHABET	US	Software and computer services	12.9	15.0%
3	MICROSOFT	US	Software and computer services	12.4	14.5%
4	SAMSUNG ELECTRONICS	South Korea	Electronics and electrical equipment	12.2	7.7%
5	INTEL	US	Technology: hardware and equipment	12.1	21.5%
6	HUAWEI	China	Technology: hardware and equipment	10.4	19.2%
7	APPLE	US	Technology: hardware and equipment	9.5	4.7%
8	ROCHE	Switzerland	Pharmaceuticals and biotechnology	9.2	19.6%
9	JOHNSON&JOHNSON	US	Pharmaceuticals and biotechnology	8.6	12.7%
10	NOVARTIS	Switzerland	Pharmaceuticals and biotechnology	8.5	18.2%

Source: European Commission website (2018)

Table 2 Global top 500 brand value ranking in pharmaceutical industry in 2017

Ranking	Brand Name	Country	Industry
22	GE	America	Pharmaceutical Technology Industry
44	CVS	America	Retail Industry
80	Walgreens	America	Retail Industry
96	Unitedhealth	America	Healthcare Service Industry
127	Anthem	America	Healthcare Service Industry
154	Johnson&Johnson	America	Healthcare Service Industry
165	Aetna	America	Healthcare Service Industry
167	Medtronic	America	Healthcare Service Industry
211	Humana Inc	America	Healthcare Service Industry
261	Roche	Switzerland	Pharmacy Industry
270	OptumHealth	America	Healthcare Service Industry
305	CIGNA	America	Healthcare Service Industry
323	Fresenius	Germany	Healthcare Service Industry
346	Pfizer	America	Pharmacy Industry
362	Bayer	Germany	Pharmacy Industry
364	Novartis	Switzerland	Pharmacy Industry
421	Express Scripts	America	Healthcare Service Industry

Table 3 Top 500 China's enterprises ranking in 2017

Number	Ranking	Pharmaceutical Enterprise	Sales Revenue (billion yuan)
1	43	China National Pharmaceutical Group Corporation	317.28
2	134	Shanghai Pharmaceuticals Holding Co., Ltd.	120.77
3	171	Guangzhou Pharmaceutical Holdings Limited	87.83
4	235	Ke Chuang Holdings Group Limited	63.67
5	240	Jointown Pharmaceutical Group Limited company	61.58
6	352	Sichuan colen Industrial Group Co., Ltd.	40.18
7	377	Taiji Group Ltd	37.88
8	408	Tianjin Pharmaceutical Group Co., Ltd.	34.87
9	432	Hangzhou Huadong Medicine Group Co., Ltd.	32.77

Source: China Enterprise Federation and China Entrepreneur Association (2017)

Table 4 Composition and weight of brand intensity factor of world brand lab method

Evaluation factors	Meaning	Weight (%)
Nature of industry	The Market Nature in Target Markets	20
Degree of support	Stakeholder's Support for Brand and Effective Communication Ability	10
Brand awareness	Standards to measure consumers' understanding and understanding of brand connotation and value	15
Brand loyalty	Brand and the products or services it represents have the ability to stabilize the customer base	15
Leadership Position	The impact of changes in brand on the market	10
Brand management	The Systematic Management Degree of Enterprise Brand	10
Expansion ability	The ability to use brand and its capital for development and promotion	10
Brand innovation	New Ability to Encourage Brand Elements to Create Value	10

Table 5 RI interpretation

n	1	2	3	4	5	6	7	8	9	10
RI	0	0	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49

Table 6 Experts' second-round scoring through the delphi method

Orders	Influencing Factors of Brand Strength	Numbers of Ticks
1	Leadership of brands in the market	20
2	Development years of brands	18
3	Growth and stability of the market in which the brand is located	20
4	The ability of brands to cross national geographic and cultural boundaries	19
5	Consistency with social development trends	20
6	Degree of governmental support	18
7	The extent to which the brand is protected by law	20
8	Brand research and development efforts	20
9	Promotion of brands	18
10	Searching times of brands in Chinese in Baidu	1
11	Establishment of a specialized brand management department	2
12	Entrusting a brand consulting company to plan	2
13	Number of product brands	1
14	Whether it has passed GMP standards or other management system certification	20
15	Legal and compliant operation	19
16	Number of complaints about product brands	1
17	Honest taxation	20
18	Public welfare support	19
19	Advertisement investment	2
20	Product or service improved based on consumer opinions	1
21	Emphasis on and investment in environmental protection	19
22	Is it a China's time-honored brand?	18
23	Corporate culture system construction	20
24	Quality of brand spokesperson	3
25	Employees care	19
26	Brand identification	17
27	Brand recognition	19
28	Brand association	19

29	Chinese goods complex	1
30	Brand loyalty	20
31	Product recommendations	18

Table 7 Experts' third-round scoring through the delphi method

Orders	Influencing Factors of Brand Strength	Numbers of Ticks
1	Leadership of brands in the market	20
2	Development years of brands	19
3	Growth and stability of the market in which the brand is located	20
4	The ability of brands to cross national geographic and cultural boundaries	19
5	Consistency with social development trends	20
6	Degree of governmental support	20
7	The extent to which the brand is protected by law	20
8	Brand research and development efforts	20
9	Promotion of brands	19
10	Searching times of brands in Chinese in Baidu	0
11	Establishment of a specialized brand management department	0
12	Entrusting a brand consulting company to plan	1
13	Number of product brands	1
14	Whether it has passed GMP standards or other management system certification	20
15	Legal and compliant operation	19
16	Number of complaints about product brands	1
17	Honest taxation	20
18	Public welfare support	19
19	Advertisement investment	0
20	Product or service improved based on consumer opinions	1
21	Emphasis on and investment in environmental protection	19
22	Is it a China's time-honored brand?	19
23	Corporate culture system construction	20
24	Quality of brand spokesperson	1
25	Employees care	19
26	Brand identification	19
27	Brand recognition	20

28	Brand association	19
29	Chinese goods complex	1
30	Brand loyalty	20
31	Product recommendations	20

Table 8 Experts' fourth-round scoring through the delphi method

Orders	Influencing Factors of Brand Strength	Numbers of Ticks
1	Leadership of brands in the market	20
2	Development years of brands	20
3	Growth and stability of the market in which the brand is located	20
4	The ability of brands to cross national geographic and cultural boundaries	20
5	Consistency with social development trends	20
6	Degree of governmental support	20
7	The extent to which the brand is protected by law	20
8	Brand research and development efforts	20
9	Promotion of brands	19
10	Searching times of brands in Chinese in Baidu	0
11	Establishment of a specialized brand management department	0
12	Entrusting a brand consulting company to plan	0
13	Number of product brands	0
14	Whether it has passed GMP standards or other management system certification	20
15	Legal and compliant operation	20
16	Number of complaints about product brands	0
17	Honest taxation	20
18	Public welfare support	20
19	Advertisement investment	0
20	Product or service improved based on consumer opinions	0
21	Emphasis on and investment in environmental protection	20
22	Is it a China's time-honored brand?	20
23	Corporate culture system construction	20
24	Quality of brand spokesperson	0
25	Employees care	20
26	Brand identification	20

27	Brand recognition	20
28	Brand association	20
29	Chinese goods complex	0
30	Brand loyalty	20
31	Product recommendations	20

Table 9 Financial statement of Y Company from 2015 to 2017 (Unit: yuan/RMB)

Project/Year	2015	2016	2017
Operating Revenue	3,168,241,317.67	3,319,829,663.97	3,620,723,532.36
Current Asset	16,903,601,748.68	22,067,687,182.74	25,103,556,999.93
Fixed Asset	1,640,213,179.39	1,782,319,408.22	1,745,371,710.46

Source: Annual Report of Y Company (2015-2017)

Table 10 Earnings of tangible assets of Y Company (2015-2017) (Unit: yuan/RMB)

Project \ Year	2015	2016	2017
Current Asset	16,903,601,748.68	22,067,687,182.74	25,103,556,999.93
Rate of Return of Current Asset	4.35%	4.35%	4.35%
Earning of Current Asset	735,306,676.81	959,944,392.45	1,092,004,729.49
Fixed Asset	1,640,213,179.39	1,782,319,408.22	1,745,371,710.46
Rate of Return of Fixed Asset	4.9%	4.9%	4.9%
Earning of Fixed Asset	80,370,445.79	87,333,651.00	85,523,213.81
Earning of Tangible Asset	815,677,122.6	1,047,278,043.45	1,177,527,943.3

Table 11 Judgment matrix A of the criterion layer

General Target	Quality Advantage	Price Advantage	Competition Advantage
Quality Advantage	1	5	2
Price Advantage	1/5	1	1/2
Competition Advantage	1/2	2	1

Table 12 Judgement matrix of quality advantages

Quality Strength B <sub>1</sub>	Enterprise Brand	Service Level	Marketing Strategy	Other Factors
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Enterprise Brand	1	2	4	5
Service Level	1/2	1	2	3
Marketing Strategy	1/4	1/2	1	2
Other Factors	1/5	1/3	1/2	1

Table 13 Judgment matrix of price advantages

Price Advantage B <sub>2</sub>	Enterprise Brand	Service Level	Marketing Strategy	Other Factors
Enterprise Brand	1	1/2	1	3
Service Level	2	1	2	5
Marketing Strategy	1	1/2	1	3
Other Factors	1/3	1/5	1/3	1

Table 14 Judgement matrix of competition advantages

Competition Advantage B <sub>3</sub>	Enterprise Brand	Service Level	Marketing Strategy	Other Factors
Enterprise Brand	1	3/2	3	4
Service Level	2/3	1	5/2	2
Marketing Strategy	1/3	2/5	1	3/2
Other Factors	1/4	1/2	2/3	1

Table 15 Judgment matrix of the brand strength criterion layer of Y Company

General Target A	Market Strength	Social Culture Strength	Consumer Strength
Market Strength	1	4	3
Social Culture Strength	1/4	1	1/2
Consumer Strength	1/3	2	1



Table 16 Judgement matrix B1 of market strength

Market Strength B <sub>1</sub>	Leader -ship	Stability	Market Power	International Power	Trend Power	Supporting Capacity	Protective Capacity	Innovation Capacity
Leadership	1	4/3	2	3/2	2	5/2	4	3/2
Stability	3/4	1	3/2	7/6	3/2	9/5	3	7/6
Market Power	1/2	2/3	1	3/4	1	5/4	2	4/5
International Power	2/3	6/7	4/3	1	4/3	5/3	8/3	1
Trend Power	1/2	2/3	1	3/4	1	5/4	2	3/4
Supporting Capacity	2/5	5/9	4/5	3/5	4/5	1	8/5	3/8
Protective Capacity	1/4	1/3	1/2	3/8	1/2	5/8	1	3/8
Innovation Capacity	2/3	6/7	5/4	1	4/3	8/3	8/3	1

Table 17 Weights of factors of market strength

Market Strength	Weight W <sub>i</sub>
Leadership	0.2101
Stability	0.1584
Market Power	0.1059
International Power	0.1394
Trend Power	0.1050
Supporting Capacity	0.0805
Protective Capacity	0.0525
Innovation Capacity	0.1481

Table 18 Judgement matrix of social culture strength

Social Culture Strength B <sub>2</sub>	Enterprise Credit	Social Responsibility	Enterprise Culture
Enterprise Credit	1	5/3	2
Social Responsibility	3/5	1	6/5
Enterprise Culture	1/2	5/6	1

Table 19 Weights of social culture strength

Social Culture Strength B <sub>2</sub>	Weight
Enterprise Credit	0.4762
Social Responsibility	0.2857
Enterprise Culture	0.2381

Table 20 Judgement matrix of consumer strength

Consumer Strength B <sub>3</sub>	Consumer Attitude	Consumer Behavior
Consumer Attitude	1	3/2
Consumer Behavior	2/3	1

Table 21 Weights of consumer strength

General Target	Weight
Consumer Attitude	0.6
Consumer Behavior	0.4

Table 22 Comprehensive evaluation scale of the market strength of brand strength of Y Company

Evaluation Scale	Very Good	Good	Average	Bad	Very Bad	Sum
Leadership	43	112	35	3	0	193
Stability	62	106	21	4	0	193
Market Power	57	93	35	7	1	193
International Power	38	104	41	8	2	193
Trend Power	35	99	47	11	1	193

Supporting Capacity	28	117	36	12	2	193
Protective Capacity	34	110	43	6	0	193
Innovation Capacity	29	98	50	14	2	193

Table 23 Comprehensive evaluation scale of the brand factor of social culture strength of Y Company

Evaluation Scale Social Culture Strength $U_2$	Very Good	Good	Average	Bad	Very Bad	Sum
	Enterprise Credit	51	100	39	3	0
Social Responsibility	39	107	42	5	0	193
Enterprise Culture	35	93	56	7	2	193

Table 24 Comprehensive evaluation scale of the consumer strength of brand strength of Y Company

Evaluation Scale Consumer Strength $U_3$	Very Good	Good	Average	Bad	Very Bad	Sum
	Consumer Attitude	63	102	24	4	0
Consumer Behavior	46	96	41	8	2	193

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## Appendix 3: Questionnaire

### Questionnaire on Brand Strength Research in China's Pharmaceutical Industry

Dear ladies/gentlemen:

Hello! I am doctoral student in public health management. This questionnaire is intended to investigate the factors that influence the brand value of the China's pharmaceutical industry. This survey is answered anonymously. The information filled in is only for my academic research and analysis. There is absolutely no other use. Thank you for your participation!

#### Part1. Basic Information

[1] Your gender? ( )

A. male                      B. female

[2] Your age? ( )

A. under 20 years old    B. 21-35 years old    C. 36-50 years old  
D. over 61 years old

[3] Your education level? ( )

A. high school or below    B. college degree    C. bachelor's degree  
D. master's degree or above

[4] Your occupation? ( )

A. Management personnel    B. Professional technical staff    C. Grassroots service staff  
D. other

[5] Your monthly income? ( )

A. Under 4000 yuan    B. 4001-7000 yuan    C. 7001-10000 yuan  
D. More than10000 yuan

### **Part 2. Market Strength Information**

[1] How much do you think brand leadership (brand position in the market) will affect brand value in the pharmaceutical industry? ( )

A. Very large    B. Large    C. General    D. Small    E. No impact

[2] How much do you think the brand stability (brand qualification and risk tolerance) affects brand value in the pharmaceutical industry? ( )

A. Very large    B. Large    C. General    D. Small    E. No impact

[3] How much do you think the market power of the brand (the market competitiveness of the brand) affects the brand value in the pharmaceutical industry? ( )

A. Very large    B. Large    C. General    D. Small    E. No impact

[4] How much do you think the international power of brand (the ability of brand to cross national geographic and cultural boundaries) affects brand value in the pharmaceutical industry? ( )

A. Very large    B. Large    C. General    D. Small    E. No impact

[5] How much do you think the trend force of the brand (in line with the social development trend) affects the brand value in the pharmaceutical industry? ( )

A. Very large    B. Large    C. General    D. Small    E. No impact

[6] How much do you think the brand support (level of government support) affects the brand value in the pharmaceutical industry?

A. Very large    B. Large    C. General    D. Small    E. No impact

[7] How much do you think the brand protection power (the degree to which the brand is protected by law) affects the brand value in the pharmaceutical industry? ( )

A. Very large    B. Large    C. General    D. Small    E. No impact

### **Part 3. Innovation Indicators of Enterprises**

[1] How much do you think the brand research and development investment affects the brand value in the pharmaceutical industry? ( )

A. Very large    B. Large    C. General    D. Small    E. No impact

[2] How much do you think the brand publicity effort affects the brand value in the pharmaceutical industry? ( )

A. Very large    B. Large    C. General    D. Small    E. No impact

[3] How much do you think the establishment of specialized brand management departments affects the brand value in the pharmaceutical industry? ( )

A. Very large    B. Large    C. General    D. Small    E. No impact

[4] How much do you think the plan of specialized brand consulting company affects the brand value in the pharmaceutical industry? ( )

A. Very large    B. Large    C. General    D. Small    E. No impact

[5] How much do you think the number of brands of the product affects the brand value in the pharmaceutical industry? ( )

A. Very large    B. Large    C. General    D. Small    E. No impact

#### **Part 4. Integrity Indicators of Enterprises**

[1] How much do you think the brand is certified by GMP or other management system or not affects the brand value in the pharmaceutical industry? ( )

A. Very large    B. Large    C. General    D. Small    E. No impact

[2] How much do you think the legal and compliance operation affects the brand value in the pharmaceutical industry? ( )

A. Very large    B. Large    C. General    D. Small    E. No impact

[3] How much do you think the number of brand complaints affects the brand value in the pharmaceutical industry? ( )

A. Very large    B. Large    C. General    D. Small    E. No impact

#### **Part 5. Social Responsibility Indicators of Enterprises**

[1] How much do you think the honest tax payment affects the brand value in the pharmaceutical industry? ( )

A. Very large    B. Large    C. General    D. Small    E. No impact

[2] How much do you think the public welfare undertakings affect the brand value in the pharmaceutical industry? ( )

A. Very large    B. Large    C. General    D. Small    E. No impact

[3] How much do you think the advertising affect the brand value in the pharmaceutical industry? ( )

A. Very large    B. Large    C. General    D. Small    E. No impact

[4] How much do you think the improvements of product or service (pre-sale, in-sale, after-sale) according to the opinions of consumers affect the brand value in the pharmaceutical industry? ( )

A. Very large    B. Large    C. General    D. Small    E. No impact

[5] How much do you think the support for environmental protection affect the brand value in the pharmaceutical industry? ( )

A. Very large    B. Large    C. General    D. Small    E. No impact

### **Part 6. Culture Indicators of Enterprises**

[1] How much do you think the time-honored brand or not affect the brand value in the pharmaceutical industry? ( )

A. Very large    B. Large    C. General    D. Small    E. No impact

[2] How much do you think the construction of culture system affect the brand value in the pharmaceutical industry? ( )

A. Very large    B. Large    C. General    D. Small    E. No impact

[3] How much do you think the quality of image spokesman affect the brand value in the pharmaceutical industry? ( )

A. Very large    B. Large    C. General    D. Small    E. No impact

[4] How much do you think the staff care affect the brand value in the pharmaceutical industry? ( )

A. Very large    B. Large    C. General    D. Small    E. No impact



### **Part 7. Cultural Indicators of Enterprise**

[1] How much do you think the brand identification of consumers affect the brand value in the pharmaceutical industry? ( )

A. Very large    B. Large    C. General    D. Small    E. No impact

[2] How much do you think the brand recognition of consumers affect the brand value in the pharmaceutical industry? ( )

A. Very large    B. Large    C. General    D. Small    E. No impact

[3] How much do you think the brand association of consumers affects the brand value in the pharmaceutical industry? ( )

A. Very large    B. Large    C. General    D. Small    E. No impact

[4] How much do you think the Chinese complex of consumers affects the brand value in the pharmaceutical industry? ( )

A. Very large    B. Large    C. General    D. Small    E. No impact

### **Part 8. Consumer Behavior Indicators**

[1] How much do you think the brand loyalty of consumers affects the brand value in the pharmaceutical industry? ( )

A. Very large    B. Large    C. General    D. Small    E. No impact

[2] How much do you think the spread effect affects the brand value in the pharmaceutical industry? ( )

A. Very large    B. Large    C. General    D. Small    E. No impact

[3] How much do you think the product recommendation affects the brand value in the pharmaceutical industry? ( )

A. Very large    B. Large    C. General    D. Small    E. No impact

### **Part 9. Other indicators**

Please list the relevant factors that you believe affect the brand value of the Chinese pharmaceutical industry.