

# Research on Social Responsibility Evaluation of Pharmaceutical Enterprises in China — Take Some International Enterprises in China as an Example

Cheng Lang and Qian Hui

**Abstract**—In recent years, social responsibility issues of pharmaceutical companies have frequently occurred, affecting people's lives and survival. More and more companies have begun to pay attention to and assume social responsibility. However, there are few studies and discussions on the issue of international pharmaceutical companies in China performing their social responsibilities in China from the perspective of consumers. Based on the research on the theory of corporate social responsibility in the past, this paper constructs the SIP model of social responsibility evaluation of international pharmaceutical companies in China from the perspective of consumers to evaluate the performance of consumer-related social responsibilities of international pharmaceutical companies in China. This study uses the entropy method to obtain a comprehensive evaluation ranking of consumer social responsibility for 16 national pharmaceutical companies in China. It expands the theoretical research on the social responsibility evaluation model of international pharmaceutical companies in China from the perspective of consumers, provides guidance and suggestions for international pharmaceutical companies in China to fulfill their social responsibilities, and provides consumers with an intuitive ranking of the social responsibility of international pharmaceutical companies in China.

**Index Terms**—Social responsibility, international pharmaceutical companies in China, entropy method.

## I. INTRODUCTION

As economic globalization continues to advance, it is becoming more common for international pharmaceutical enterprises to set up controlled corporation in China. While domestic and foreign pharmaceutical enterprises are meeting people's growing demand for medicines, the company are also pursuing larger markets and high profit returns [1]. The pharmaceutical industry is different from other industries. Drug safety incidents will directly endanger the lives of the public. International pharmaceutical enterprises in China occupy an important position in the Chinese pharmaceutical industry, and their market share is constantly increasing. The performance of their social responsibility is related to the survival and life of the people. In recent years, more and more scholars in the field of corporate social responsibility research have started to pay attention to the social responsibility of pharmaceutical enterprises. However, these studies mainly focus on the social responsibility of domestic hospitals and

pharmaceutical companies, and rarely focus on the fulfillment of social responsibility of international pharmaceutical enterprises, rarely evaluate from the perspective of consumers. Based on the research on social responsibility of the pharmaceutical industry in the past five years, this paper proposes a social responsibility evaluation model for international pharmaceutical enterprises in China from the perspective of consumers. The entropy method is used to conduct comprehensive evaluation research on the public financial data and corporate behavior characteristics of international pharmaceutical enterprises in China, and analyze the comprehensive evaluation ranking to explore the social responsibility performance of international pharmaceutical enterprises in China from the perspective of consumers.

## II. LITERATURE REVIEW AND CONSTRUCTION OF EVALUATION MODEL

### A. Literature Review

Among the research results of foreign scholars, Carroll's pyramid model is representative in the classification of corporate social responsibility which divided corporate social responsibility from economic importance to legal, moral, and charitable responsibility [2]. The three concentric circles and triple bottom line theory are also divided into different levels according to the content of corporate social responsibility. From the perspective of the object of responsibility, the scholar Friedman proposed the stakeholder theory, and from this point Friedman created the division of responsibility from the perspective of stakeholders. Under the guidance of this classic theory, most scholars define the social responsibility content of pharmaceutical enterprises. The academic community generally believes that enterprises should fully consider the social responsibilities of stakeholders, but based on three aspects: economic responsibility, legal responsibility, and moral responsibility. From the form of responsibility performance, invisible and explicit social responsibility is proposed by the American Management Association Review, so as to divide corporate social responsibility in different forms of implementation [3].

Chinese scholars believe that building a corporate social responsibility evaluation system requires understanding that the construction of the responsibility system is a dynamic

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process and based on facts, it also needs to consider mainstream values [4]. We need to use this principle as a guide to design the evaluation system. Most domestic researches are based on the introduction of foreign theories. The "Diamond Model" corporate social responsibility evaluation model is put forward under the traditional evaluation model, in the economic value creation, social value creation, environmental value creation, transparent operation basic evaluation dimensions, the introduction of responsibility concepts and strategies, social responsibility promotion management Auxiliary evaluation dimension to achieve comprehensive reflection of social responsibility level [5]. Fu Gang and Wu Fanlu explored the new model of triple surplus corporate social responsibility evaluation and thought that there were still problems in its operability and universal applicability [6]. The Corporate Social Responsibility Research Center of the Chinese Academy of Social Sciences proposed to establish a corporate social responsibility performance evaluation system with responsibility management as the core, market responsibility as the cornerstone, and social responsibility and environmental responsibility as the two wings [7]. The existing theories around the three aspects of economics, society and environment are relatively dynamic, but they have low strategic relevance to enterprises, and there are problems with the authenticity of information. The corporate social responsibility framework needs to be further clarified [8].

*B. Construction of Evaluation Model*

When constructing an international pharmaceutical corporate social responsibility evaluation model, it first reviewed the corporate social responsibility evaluation model in the past five years of research and summarized the indicators of pharmaceutical corporate social responsibility evaluation from the perspective of consumers, which mainly focused on three aspects: products, information, and services. In terms of products, from the perspective of product quality, Wen Subin and Fang Yuan proposed whether to pass ISO9000 certification as one of the indicators to measure customer responsibility [9]. Jiang Hongyun and Jing Shanshan certified the product of the treatment volume management system and the product passed the certification [10]. The number is used as an evaluation index for

measuring consumer social responsibility of listed enterprises in the pharmaceutical manufacturing industry. In addition to ISO9000 certification, the pharmaceutical industry also has GMP certification. "Can pass GMP certification" as the quality evaluation index. In the perspective of product research and development, Jiang Hongyun and Jing Shanshan proposed the number of patents owned by the company and product research and development expenditures as indicators of corporate social responsibility regarding research and development [10].

This article draws on this research to take the number of patents and the proportion of product R & D expenditures as evaluation indicators for product R & D. From the perspective of product market recognition, Yao Yan, Yu Xiaoping, Wang Dan, Zhu Boqiang, Mao Shuzhen, Le Guolin, and Wu Yanghui all use the growth rate of main business income as a test to determine whether the products provided by the company have been recognized by the market [11]-[13]. To measure the performance of corporate social responsibility from the perspective of consumers. From the perspective of product public interest, Jiang Hongyun, Jing Shanshan, Li Jijia, Mao Ningying, Mao Shuzhen, Le Guolin, Wu Yanghui, Huang Dangling, Zhang Yao, Cao Simin pointed out that the cost rate of the company's main business is an important indicator for evaluating corporate social responsibility, and eight researchers attributed it to the category of customer responsibility [10], [13]-[15]. In addition to the main business cost rate, Maisheng, Kuang Haibo, and Zhang Xiaona also introduced profit margin indicators to measure the status of corporate social responsibility fulfillment [16].

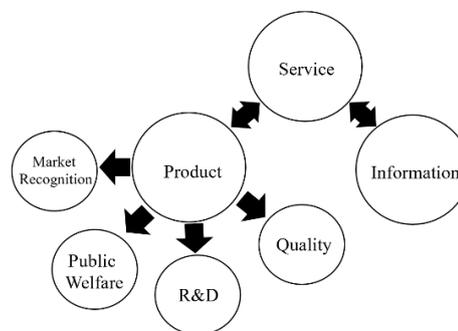


Fig. 1. SIP model of corporate social responsibility evaluation from the perspective of consumers.

TABLE I: INTERNATIONAL CSR EVALUATION INDICATORS OF PHARMACEUTICAL ENTERPRISES IN CHINA

AREA	FIRST-LEVEL	SECOND-LEVEL	CALCULATIONS	NUMBER
Product	Quality	GMP Certification	Have 1, No 0	P01
Product	R&D	Number of Patent	Numbers	P02
Product	R&D	R & D Spending Rate	$R \& D \text{ Expenditure} / \text{Cost} * 100\%$	P03
Product	Market Recognition	Income Growth Rate	$(\text{Main Business Income for The Current Year} - \text{Main Business Income For The Previous Year}) / \text{Main Business Income For The Previous Year} * 100\%$	P04
Product	Public Welfare	Selling Rate	$\text{Profit} / \text{Cost} * 100\%$	P05
Product	Public Welfare	Cost Rate	$\text{Cost} / \text{Revenue} * 100\%$	P06
Information		Annual Report Disclosure	Hierarchical Scoring (1-5 Points)	P07
Information		Social Responsibility Report	Hierarchical Scoring (1-5 Points)	P08
Service		Product Information	Are There Any False Propaganda Events In The Past Three Years? Yes 0, No 1	P09
Service		Consumer Satisfaction Research	Have 1, No 0	P10

In terms of information, corporate social responsibility mainly lies in the disclosure of information. Pharmaceutical

enterprises mainly use social responsibility reports to ensure that stakeholders understand basic corporate information. Jiang Hongyun and Jing Shanshan introduced this indicator in their research. In addition, the disclosure of the company's annual report also helps consumers understand the overall status of the company [10]. Therefore, the disclosure of social responsibility reports and corporate annual reports has become an important indicator for evaluating social responsibility performance in corporate information.

In terms of services, Mao Shuzhen, Le Guolin, and Wu Yanghui focused on whether a company has a consumer satisfaction survey to determine the company's attitude toward consumers and conduct corporate social responsibility evaluations [13]. In addition, medicines have side effects, so companies have the responsibility to provide comprehensive information about medicines. Yang Xiaoyan and Xu Pei used the full information of the product as an evaluation index [17]. Whether to provide real product information, that is, whether vicious business events such as false publicity occurred, was measured as an evaluation index. In the process of index induction, a SIP model of corporate social responsibility evaluation from the perspective of consumers (Fig. 1) was proposed, and the international CSR evaluation indicators of pharmaceutical enterprises in China were selected (Table I).

### III. EMPIRICAL RESEARCH

#### A. Data Sources and Sample Selection

This article is based on the Pharm Exec magazine published in June in the United States in 2019. Based on Pharm Exec's Top 50 Enterprises 2019, international pharmaceutical enterprises in China are selected as the subject of the survey. The sample is mainly selected by companies with a high reputation in China and a high market share. At the same time, it is necessary to consider whether the public data of the company is convenient to query and whether the public information of the corporate website is complete. After preliminary data inquiry, 16 enterprises were identified as the survey samples for this CSR evaluation. The data sources are the company's 2016-2018 public financial annual report, the information search platform of the China Industry and Commerce Bureau, the company's Chinese official website and international official website, and the SOOPAT patent search platform.

#### B. Research Method

The idea of combining the physical concept of "entropy" with management is the first proposed by Professor Ren Peiyu. Management entropy extracts a common feature from many factors. The system development status is judged in an orderly and disorderly manner, making the evaluation in-depth and objective [18]. The entropy method can be used to explain the order of social responsibilities of international pharmaceutical enterprises in China. By revealing the changing state of the organization, it reflects the development direction and degree. Using entropy to explain, the conclusions reached are more objective and comprehensive [19]. Qing Fang and Raleigh have applied the method of management entropy to the evaluation of hospital performance, and successfully combined the management

evaluation and entropy of the medical industry, bringing a new dynamic perspective to the evaluation of hospital management performance [20]. The entropy method can be used to determine the weight of each indicator. By analyzing the degree of connection between the indicators and the amount of information provided by the indicators, the weight deviation caused by subjective weighting in the comprehensive evaluation process can be avoided.

The evaluation system has  $N$  evaluation objects and  $P$  indicators, so the matrix is obtained,

$$X = \begin{pmatrix} X_{11} & X_{12} & \dots & X_{1p} \\ X_{21} & X_{22} & \dots & X_{2p} \\ \dots & \dots & \dots & \dots \\ X_{n1} & X_{n2} & \dots & X_{np} \end{pmatrix}$$

Normalize the matrix to get  $R = (r_{ij})_{n \times p}, r_{ij} \in [0, 1]$

The larger the indicator value, the better:  $r_{ij} = \frac{X_{ij} - \min X_{ij}}{\max X_{ij} - \min X_{ij}}$

The smaller the indicator value, the better:  $r_{ij} = \frac{\max X_{ij} - X_{ij}}{\max X_{ij} - \min X_{ij}}$

The indicator is appropriate:  $r_{ij} = 1 - \frac{|x_{ij} - \bar{x}_{ij}|}{\max |x_{ij} - \bar{x}_{ij}|}$

Calculate the  $j$  specific weight of  $i$  objects:  $P_{ij} = \frac{r_{ij}}{\sum_{i=1}^n r_{ij}}$

Calculate the entropy of the  $j$ -th index:  $e_{ij} = -k \sum_{i=1}^n P_{ij} \ln P_{ij}, (j = 1, 2, 3, \dots, p)$

$k = \frac{1}{\ln n}, P_{ij} = 0$ . Then  $P_{ij} \ln 0 = 0$

Calculate the entropy weight of the  $j$ -th index:  $W_j = (1 - e_j) \sum_{j=1}^p (1 - e_j), (j = 1, 2, 3, \dots, p)$

Calculate the composite value of the  $i$ th object:  $T_i = \sum_{j=1}^p r_{ij} W_j (i = 1, 2, 3, \dots, n)$

Use the comprehensive evaluation value to sort, the larger the evaluation value is, the better it is.

#### C. Calculation

The calculation of the indicators is based on the calculation methods listed in Table I. The data of the information elements are judged by judging the disclosure of the annual report and corporate social responsibility report of the company. Data of service elements are used to retrieve corporate behaviors through a network platform to determine whether it provides real product information and whether there is a consumer satisfaction survey. Product category data are corporate financial data and corporate patent ownership. Entropy weights are calculated using the entropy method. Table II shows the results of entropy weights corresponding to the secondary indicators in each element. After determining the entropy weight of the secondary indicators under each responsibility element, calculate the scores of the three types of responsibility elements of 16 enterprises. Final evaluation ranking is shown in Table III.

#### D. Analysis

According to the comprehensive evaluation scores and rankings of the enterprises in Table III, Novartis scores much higher than other enterprises, ranking first. Lilly reflects in this study that its social responsibility performance is poor. Abbott, Roche and Bristol-Myers Squibb also performed well. Pfizer's sales over the years are higher than other enterprises, but the performance of social responsibility is ranked fifth in

this measurement. In addition, Amgen, Gilead, and GlaxoSmithKline performed poorly in this social responsibility evaluation. Table III reflects the performance of corporate social responsibility and requires further analysis.

The reasons why Novartis can achieve higher entropy are mainly due to the large number of patent applications in China and the good performance of its main business cost ratio. On the contrary, the entropy right of the number of patents in this study is relatively high, and Lilly applied for a small number of patents in China, and its average profit margin performance was average, resulting in the lowest overall evaluation. In terms of products, Novartis, Roche and Abbott performed well, while Lilly, GlaxoSmithKline and

Bristol-Myers Squibb performed poorly. In terms of average profitability, Abbott, Fresenius, and Gilead have outstanding performance. In terms of cost of main business, Fresenius and Takeda Shire have performed better. It is good. In terms of average R & D expenditure rate, Gilead, Roche, Novartis, and Merck performed well, and Novartis, Roche, and Abbott performed well in terms of patents. In general, Novartis and Roche perform their social responsibilities in research and development. From the perspective of market growth rate, we can see that Fresenius, GlaxoSmithKline, and Takeda Shire have been highly recognized in the Chinese market in recent years.

TABLE II: ENTROPY WEIGHTS

AREA	FIRST-LEVEL	SECOND-LEVEL	ENTROPY WEIGHT	NUMBER
Product	Quality	GMP Certification	0	P01
Product	R&D	Number of Patent	0.34	P02
Product	R&D	R & D Spending Rate	0.13	P03
Product	Market Recognition	Income Growth Rate	0.41	P04
Product	Public Welfare	Selling Rate	0.08	P05
Product	Public Welfare	Cost Rate	0.03	P06
Information		Annual Report Disclosure	0.39	P07
Information		Social Responsibility Report	0.61	P08
Service		Product Information	0.76	P09
Service		Consumer Satisfaction Research	0.24	P10

TABLE III: EVALUATION RANKING

RANK	NAME	ENTROPY	RANK	NAME	ENTROPY
1	Novartis	161.5	9	Mercadon	32.75
2	Abbott	57.31	10	Fresenius	23.41
3	Roche	54.22	11	Novo Nordisk	21.75
4	Bristol-Myers Squibb	48.88	12	Abbey	17.22
5	Pfizer	43.46	13	Amgen	.83
6	AstraZeneca	42.86	14	Gilead Science	10.19
7	Johnson & Johnson	40.21	15	GlaxoSmithKline	7.27
8	Takeda Shire	38.28	16	Lilly	1.2211

In terms of services and information, Novo Nordisk, Pfizer, and Lilly have performed well in the elements of information responsibility. Merck and Bristol-Myers Squibb have performed poorly, and AbbVie has performed prominently in the elements of service responsibility. The annual reports and social responsibility reports of Pfizer and Novo Nordisk are basically timely, accurate, and transparent. However, most other enterprises are unable to synchronize the information on the Chinese official website and the global official website, resulting in Chinese consumers being unable to fully understand the company. Happening. Among the service elements, most enterprises have had false propaganda in the past, and only half of them have done a timely investigation of consumer satisfaction.

Most of the companies in this study had problems with product research and development. Most of them did not set up research centers in China, applied for patents, and had a weak research vitality in China. They did not conduct research on the Chinese market. Secondly, enterprises have problems with services. Most companies have false propaganda incidents and half of them have not investigated consumer satisfaction in a timely manner. In terms of information disclosure, China's official website is not synchronized with global official website information,

making it impossible for Chinese consumers to keep abreast of enterprises and their social responsibility performance, which is a problem that most enterprises need to improve in time.

#### IV. DISCUSSION

The purpose of this study is to discuss the performance of social responsibility of international pharmaceutical enterprises in China. Based on the social responsibility research in recent years, a SIP model is constructed, and the social responsibility evaluation model of international pharmaceutical enterprises in China is derived. Through the entropy method, the entropy weights of the three types of responsibility factors of products, services and information of 16 enterprises are calculated, and the social responsibility ranking of 16 enterprises is obtained. Through observation, it is found that there is a difference between the performance of social responsibility and the ranking of sales of international pharmaceutical enterprises in China. Analysis and ranking shows that international pharmaceutical enterprises need to improve their research on the Chinese market, information disclosure and synchronization, and customer service. From the perspective of liability elements, there are false

propaganda in the sales process of enterprises in the service liability elements, especially those with high sales rankings, which have a certain misleading effect on consumers with exaggerated advertising words, without providing real product information. The official Chinese websites of the enterprises in the information element did not synchronize the information in a timely manner, and only half of the enterprises focused on customer satisfaction with the brand and its products. Among the product elements, some enterprises in research and development have not set up research laboratories in China to investigate and study Chinese consumer groups, which has led to poor performance in this comprehensive corporate social responsibility ranking. However, most enterprises have performed well in terms of product quality, public welfare, and market recognition. The financial data reflects that international pharmaceutical enterprises in China have performed well in the main business production cost rate indicators, and R & D expenditures have a larger proportion of total expenditures. The product is highly recognized by the market and the business performance in the past three years has shown an increasing trend. It is recommended that international pharmaceutical enterprises in China achieve timely information synchronization, strengthen product research and development for Chinese consumer groups, and actively investigate customers and apply for patents in China while exploring the market, focusing on consumer satisfaction and providing authentic product information.

The social responsibility issues of international pharmaceutical companies in China discussed in this article are in the same line as related international research. In fact, this article and similar studies show that as the times change and academic research continues to refine, the research model in the field of social responsibility will gradually expand and refine. This study also has some shortcomings: First, there is a certain deviation in the construction and calculation of secondary indicators. The secondary indicators of service and information elements in the SIP model are not yet complete, and the secondary indicators involve few aspects. There is a certain degree of subjectivity in the evaluation methods of service and service information elements, and more objective and scientific evaluation methods should be introduced. All of the above need to be further improved in research. The SIP model proposed in this research can adjust the variables of secondary indicators in the following research, making the research more in-depth and practical. Other methods can also be considered for the evaluation methods of service and information responsibility elements to enhance the scientific nature of the research. In addition, due to the limitations of the experiment, this article only discusses the implementation of social responsibilities of some international pharmaceutical companies in China, and the sample scope needs to be expanded. Scholars can continue to discuss the research model of international companies in China along with the theoretical updates in the field of social responsibility.

#### CONFLICT OF INTEREST

The authors declare no conflict of interest.

#### AUTHOR CONTRIBUTIONS

Cheng Lang conducted the research, proposed a model and analyzed the data; Qian Hui determined the direction of the topic, provided the experimental ideas, and checked the results of the final data analysis; All authors had approved the final version.

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