A study on the Development of Biopharmaceutical Companies Based on the Context of Big Data

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Abstract. Based on the requirements of the computer technology background in the new era, this paper takes Chinese biopharmaceutical enterprises as the research object, outlines the general characteristics of innovation in Chinese biopharmaceutical enterprises, and analyses the current situation of innovation development in biopharmaceutical enterprises from four aspects: policy, economy, society and technology, followed by an analysis of the current problems faced by innovation in Chinese biopharmaceutical enterprises and the reasons for their generation. Based on literature research, theoretical studies and analysis of the causes of the current innovation problems of Chinese biopharmaceutical enterprises, the factors affecting the innovation performance of Chinese biopharmaceutical enterprises are summarised. The specifics of the conditional variables, as well as the outcome variables, are then identified according to the specific manifestations of poor innovation performance of biopharmaceutical firms. Finally, corresponding countermeasures are proposed in terms of the level of corporate R&D investment, the level of financing channels, the level of government policy support, and the internal management of biopharmaceutical companies, in conjunction with the characteristics of different path models. This paper combines the big data foundation to research and analyse the development of biopharmaceutical enterprises, laying a new research foundation and providing a more efficient research path for the development of the biopharmaceutical industry.

1. Introduction

Biopharmaceutical companies in China are facing unprecedented opportunities for development, and innovation, as the core competence of biopharmaceutical companies, is of great importance to them [1]. Innovation drives the development of biopharmaceutical companies. Globally, along with the expanding scale of the global biopharmaceutical market, the core competition of the global biopharmaceutical industry is mainly focused on the competition of innovation ability and technology level, and the innovation breakthrough of biopharmaceutical technology determines the future development pattern of the global biopharmaceutical industry [2]. Therefore, how to activate innovation factors more effectively under the new situation and accelerate innovation in biopharmaceutical enterprises is of great significance to promote the development of China's biological enterprises and seize the high point of future competition in the global biopharmaceutical industry. Therefore, studying how to improve the innovation capability and performance of biopharmaceutical enterprises is undoubtedly an important topic for the development prospect and competitive position of biopharmaceutical enterprises [3]. This paper examines the development of pharmaceutical companies in the new era and new industry dynamics, which play a very important role in the progress of the industry.

2. The Overall Development Status of Innovation in China's Biopharmaceutical Companies

2.1. Policy: Successive Relevant Policies to Provide Protection for Innovation

In recent years, as people's awareness of health care has increased and their spending power has grown, the biopharmaceutical industry has become a key industry in China's national health, as well as a new economic growth point for the national economy [4]. As a result, it has received a great deal of attention from various relevant authorities, including the General Office of the State Council, the State Health and Planning Commission and the State Food and Drug Administration, which have issued several policies in recent years to stimulate and fund innovation in the biomedical industry [5].

2.2. Economic Aspects: Market Size Rises to Lay the Foundation for Innovation

In the same way that innovation in a small business needs to be based on its own scale of development,

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innovation in an industry needs to be supported by the size of that industry's market [6].

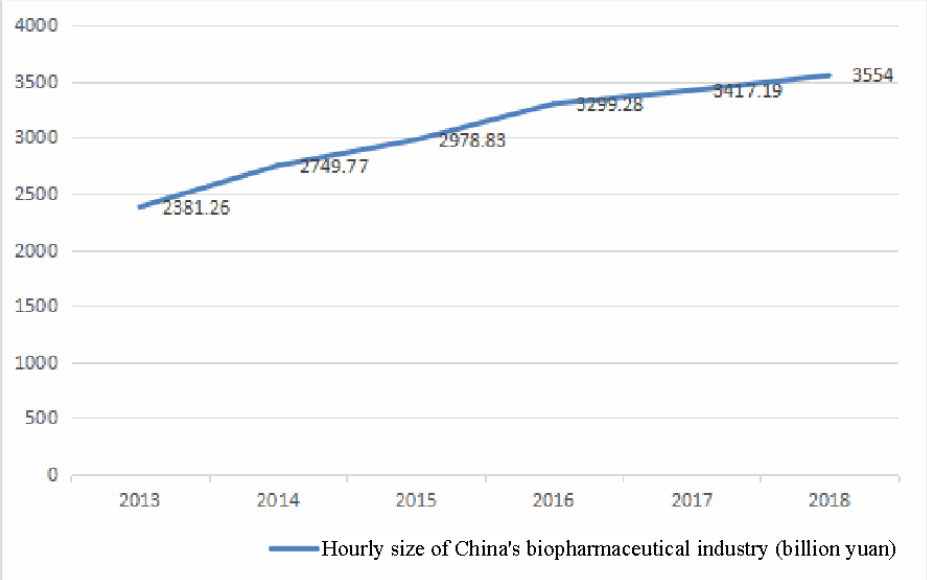

Figure 1. Changes in the market size of China's biopharmaceutical industry.

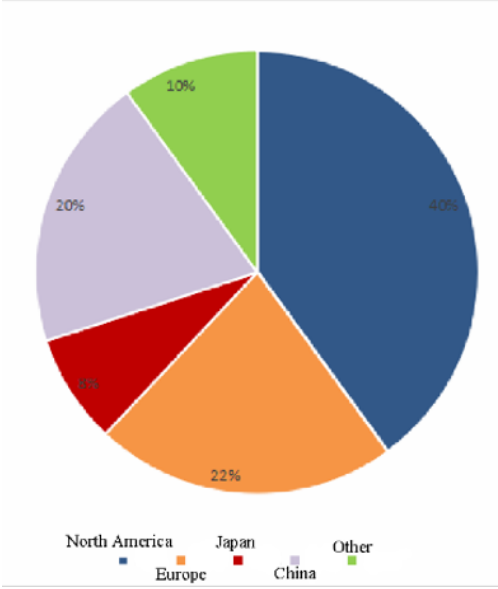

Figure 2. Global biopharmaceutical market size distribution

From a longitudinal point of view, it can be seen from Figure 1 that the market size of the domestic biopharmaceutical industry in the past six years has shown a continuous growth trend and the growth rate has been continuously improved [7]. Specifically, the market size of China's biopharmaceutical industry reached 274.977 billion yuan in 2014, its growth rate being the largest in the past six years. And while the market size of the biopharmaceutical industry began to grow at a reduced rate in 2017, it still reached a high of $341.719 billion. Overall, therefore, the domestic market size of the biopharmaceutical industry in China continues to increase [8].

In a side-by-side comparison, the international distribution of the proportion of market share in the biopharmaceutical industry is shown in Figure 2 above, from which it can be seen that our biopharmaceutical industry accounts for 20% of the global market share, which is a very high share as a country. Although the share of North America and Europe is larger than that of China, it is relatively higher because it is the combined share of several countries [9].

2.3. Social Aspects: Strong Demand for Health Protection Drives Innovation

The pace of population ageing in China has started to accelerate since the 21st century, and the health protection needs of the elderly are the highest of all groups.

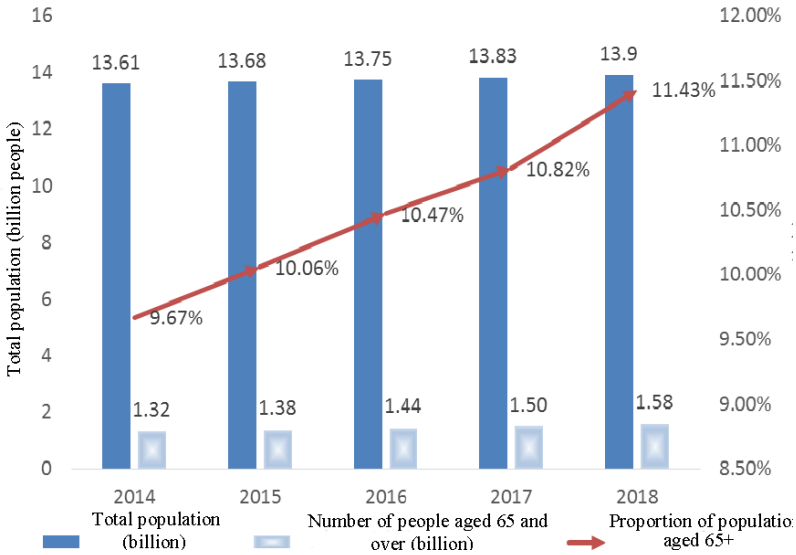

Figure 3. Map of our changing population structure

Figure 3 depicts the demographic changes in China over the past five years. From the figure, it can be seen that the total population of China has stabilised in recent years, but the number of elderly people aged over 65 has been growing and the proportion of the total population has been expanding, reflecting the trend that the process of population ageing in China is gradually accelerating [10].

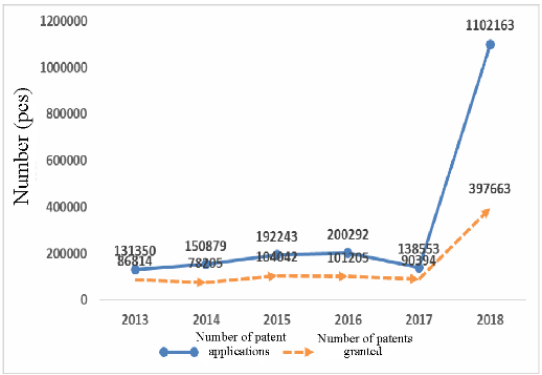

Figure 4. Changes in patent applications by biopharmaceutical companies in China

Figure 4 depicts the changes in China's total health expenditure and the proportion of total health expenditure to GDP over the past six years. As can be seen from the figure, China's total health expenditure has been on a constant growth trend in recent years and is expanding as a proportion of GNP, reflecting the reality of the growing total health needs of our people, which represents an unprecedented opportunity for the development of biopharmaceutical companies in China.

2.4. Technology: Big Data Technology Provides Health Data for Innovation

With the development of modern science and technology, science and technology will provide more new technical means for biomedical innovation, thus improving the hardware level for innovation and development of biomedical enterprises.

Although there has been an overall increase in the number of patent applications and patents granted in the biomedical field in China in the last five years (see Figure 5 below), most of the patents are mainly design patents and lack original invention patents.

3. Big Data Algorithm Analysis

This section firstly enhances the feature extraction of time series by introducing the concept of bursty component, and secondly uses different methods to extract seasonal component, bursty component, random error component and vertical/horizontal trend component for the initial data in turn according to the core performance index characteristics of mobile communication networks, and carries out anomaly detection and processing according to the feature extraction process, on which the pre-processed data is predicted and analysed by the four feature extraction results. Figure 5 illustrates the flow chart of the Big Data prediction algorithm.

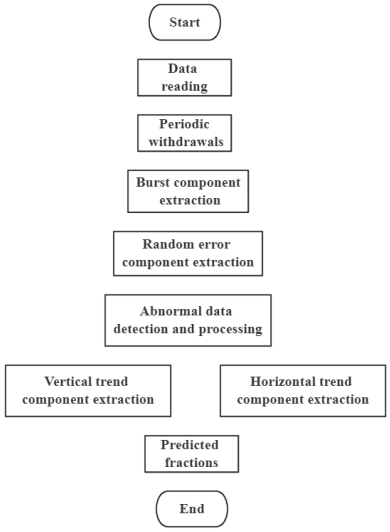

Figure 5. Flow chart of big data prediction algorithm

The feature extraction process is in turn for the periodic component, the burst component, the random error component and the trend component, where the correct extraction of the periodic component is a prerequisite for the extraction of the other components. The process is shown below:

3.1. Periodic Component Feature Extraction

Due to the relevance of mobile performance indicators and the high degree of similarity in the variation patterns of sequences of adjacent cycles, the least squares based method can be used to determine the cycle values of the sequences. The matrix A (where $m > 7 * 48$ and $n > 50$) is first obtained by differencing the time series $X\{x_1, x_2, x_3, \ldots, x_M\}$ (xi range $V_1 - V_2$) according to Eq. (1), as follows:

$$A = \begin{bmatrix} x_2 - x_1 & x_3 - x_2 & \cdots & x_{n-1} - x_{n-2} \\ x_3 - x_1 & x_4 - x_2 & \cdots & x_n - x_{n-2} \\ \cdots & \cdots & \cdots & \cdots \\ x_m - x_1 & x_{m+1} - x_2 & \cdots & x_{n+m-3} - x_{n-2} \end{bmatrix} \quad (1)$$

A linear fit is performed for each row of matrix A with parameters noted as $(a_1, a_2, \ldots, a_{m-1})$, $(b_1, b_2, \ldots, b_{m-1})$, and the subscripts of each row of A are substituted into the corresponding $Y = aN + b$ to obtain the corresponding A1, as shown in Eq. (2).

$$A1 = \hat{a}\hat{N} + \hat{b} = \begin{bmatrix} a_1 \\ a_2 \\ \vdots \\ a_{m-1} \end{bmatrix} \begin{bmatrix} \overbrace{\begin{matrix} 1 & 2 & \cdots & n-2 \\ 1 & 2 & \cdots & n-2 \\ \cdots & \cdots & \cdots & \cdots \\ 1 & 2 & \cdots & n-2 \end{matrix}}^{n-2} \end{bmatrix} + \begin{bmatrix} b_1 \\ b_2 \\ \vdots \\ b_{m-1} \end{bmatrix} \quad (2)$$

3.2. Random Error Component Feature Extraction

Each row of matrix B is first taken out in turn to obtain a total of N sub-time series $\{x_1, x_2, \cdots, x_L\}, \{x_{L+1}, x_{L+2}, \cdots, x_{2_L}\}, \cdots, \{x_{N*L+1}, x_{N*L+2}, \cdots, x_M, x_A, \cdots\}$ denoted as $N_1 \sim N_N$, where each N_i series has L data (all values after x_M within N_N are NA). Then the statistical analysis of the sequence X, to obtain the distribution model $X \sim F(x)$ of the sequence X, $(V_1 \leq x \leq V_2)$, for all the sequences Ni, according to the F(x) distribution model can get a brand new set of sequences $N_1^{`}, N_2^{`}, \ldots, N_N^{`}$, the inner elements are subtracted in turn to obtain N random error sequences, denoted as $R_t(i)$, according to $R_t(i)$ can get the random error distribution model of each sequence N_i, denoted as $N_{e1} \sim F_{e1}(r)$, $N_{e2} \sim F_{e2}(r), \cdots, N_{eN} \sim F_{eN}(r)$ where.

$$F_{ei} = \sum_{Rimin}^{Rimax} P_i(r) \quad (3)$$

Based on all $R_t(i)$, a random error distribution model for the sequence X, denoted $X_e \sim F_e(r)$, can be obtained.

$$F_e = \sum_{Rmin}^{Rmax} P(r) \quad (4)$$

According to the random error distribution model, the random error distribution range of the sequence X can be obtained.

4. Conclusion

The main contents discussed in detail in this paper include the following aspects: (1) introduce the characteristics of the innovation process of biopharmaceutical enterprises in China, summarize the four main characteristics of innovation activities, such as long R&D cycle, high cost of innovation capital investment, high risk of failure of R&D and innovation, as well as complex innovation activities and many subjects involved, so as to understand more deeply the innovation activities of biopharmaceutical enterprises in China; (2) through the relevant literature (2) to analyse the current development status of innovation in biopharmaceutical enterprises in China from four aspects: policy, economy, society and technology; (3) to summarise the common problems faced by biopharmaceutical enterprises in the process of innovation in China, and to analyse the causes of these problems from the aspects of personnel, capital, cognition and operation.

References

1. Chen Huaijin. Ideas and countermeasures for accelerating the digital transformation of China's biopharmaceutical industry[J]. China Economic and Trade Journal,2023(02):68-71.
2. Feng Hong, Du Qian. Intellectual property protection of biomedical patent technology under big data[J]. Biology teaching in secondary schools,2022(36):81.
3. Cui Bei. Research on the development strategy of biomedical innovation system[D]. Academy of Military Sciences, 2022. DOI: 10.27193/d.cnki.gjsky.2022.000013.
4. Li Pengcheng. Research on the evolution of Hangzhou biopharmaceutical industry innovation network[D]. Zhejiang Normal University, 2022. DOI: 10.27464/d.cnki.gzsfu.2022.000660.
5. Zhang Yang. Research on marketing strategy of financial leasing business in biomedical market of company H [D]. Shandong University, 2022. DOI: 10.27272/d.cnki.gshdu.2022.002251.
6. He Jianglin. Research on the marketing strategy of Ganzhou Y Biomedical Company[D]. Nanchang University, 2022. doi: 10.27232/d.cnki.gnchu.2022.002989.
7. Liu Huaxiang. Research on the improved model of market approach for valuation of loss-making biopharmaceutical enterprises on science and technology innovation board [D]. Tianjin University of Commerce, 2022. doi: 10.27362/d.cnki.gtsxy.2022.000359.
8. Inyoung S,N. K H. New media use and the belief in a just world: awareness of life events and the perception of fairness for self and injustice for others[J]. Information, Communication & Society,2023,26(2).

9. A L L. Points of departure: Reflections on New Media & Society and the next 25 years in new media studies[J]. New Media & Society,2023,25(1).
10. Cinzia R,Anna C S,Juan M G. New media literacies;for transmedia learning. How students are regarding their transliteracy in Italian;licei classici[J]. Cogent Education,2022,9(1).