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Retraction

Retracted: Multiobjective Differential Evolution Clustering Algorithm Based on Multimedia Information in Working Mechanism Innovation for Traditional Chinese Medicine

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] X. Zhu, H. Cheng, X. Zhang, H. Zhu, and Z. Sun, "Multiobjective Differential Evolution Clustering Algorithm Based on Multimedia Information in Working Mechanism Innovation for Traditional Chinese Medicine," *Advances in Multimedia*, vol. 2022, Article ID 4135439, 12 pages, 2022.

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Research Article

Multiobjective Differential Evolution Clustering Algorithm Based on Multimedia Information in Working Mechanism Innovation for Traditional Chinese Medicine

Xiaoling Zhu,[1] **Hongsheng Cheng**,[2] **Xu Zhang**,[1] **Huaxu Zhu**,[1] **and Zhiguang Sun**[1]

[1]*Nanjing University of Chinese Medicine, Nanjing, China*
[2]*Yancheng Teachers University, Yancheng, China*

Correspondence should be addressed to Xiaoling Zhu; 2021004091@poers.edu.pl

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Aiming at working mechanism innovation for traditional Chinese medicine, a multiobjective differential evolution clustering algorithm based on multimedia information is proposed and applied. In promoting the international development of the traditional Chinese medicine industry, R&D innovation and working mechanism innovation must be paid attention to. This paper takes a specific Chinese medicine company as an example, combined with differential evolution clustering algorithm to effectively help Chinese medicine enterprises choose a more suitable innovation model. This paper starts with specific cases and carries out research from the microperspective of traditional Chinese medicine enterprises. It believes that in the process of international development, traditional Chinese medicine enterprises must base on overseas investment in R&D and innovation, strengthen self-help innovation, further enhance their R&D stamina through working mechanism innovation, gradually open overseas markets, and realize the internationalization of traditional Chinese medicine.

1. Introduction

The mining and reuse of multimedia information is in full swing in all walks of life. In order to provide a more effective way for product R&D and innovation in the process of international development of pharmaceutical manufacturing enterprises, we should use the international network to innovate the technology R&D mechanism and further promote the traditional Chinese medicine industry to better move towards modernization and internationalization. This paper takes a specific Chinese medicine company as an example, combined with differential evolution clustering algorithm to effectively help Chinese medicine enterprises choose a more suitable innovation model [1, 2]. Through the model experiment, it is found that with the help of DB model as the basis, the optimal cluster number of MOKGA is 2, and the most appropriate cluster number is 3 according to SLW selection, which also shows the rationality of the view of the clustering algorithm and shows that the algorithm can effectively help to select the appropriate model and select the solution of the most appropriate cluster number, which verifies the feasibility and effectiveness of the algorithm. From the microperspective, this paper focuses on the innovation path of the working mechanism of traditional Chinese medicine companies. This development trend is to obtain more advanced technologies from the foreign pharmaceutical industry and better promote the R&D and innovation of the domestic pharmaceutical industry. From the current situation of the development of the domestic traditional Chinese medicine industry, low innovation ability, financing constraints, and limited drug R&D capacity are the main factors restricting the international development of the industry.

2. Literature Review

As one of the internationalization behaviors of enterprises, many scholars' research shows that foreign direct investment

is an effective way to obtain overseas advanced technology. Some scholars have studied the technology spillover effect of direct investment in developed countries through regression of foreign technology scalars and enterprise technology variables and concluded that the restrictions on export trade of countries with relatively backward technology have promoted the number of their foreign investment and entered technology intensive industries through mergers and acquisitions to obtain knowledge upgrading, proving the existence of technology acquisition OFDI [3]. Through the analysis of overseas direct investment in Asian developing countries and regions, some scholars found that most of these direct investment are tacit knowledge seeking outward direct investment aimed at expanding overseas markets, acquiring advanced technology and improving their own brands; research shows that in order to catch up with advanced technology enterprises in developed countries, emerging technology enterprises in developing countries acquire overseas advanced technology in the form of overseas R&D activities.

After proving the existence of technology-acquired foreign direct investment, whether foreign investment can promote the improvement of enterprises' own innovation ability and how technology-acquired foreign direct investment affects enterprises' innovation ability have become the concerns of scholars. Some scholars used the cointegration method to study the impact of Chinese enterprises OFDI, FDI, import, and export trade on the number of domestic patents and R&D expenditure and concluded that China's OFDI played a promoting role in improving the number of domestic patents. Using the negative binary regression model, based on the data of listed manufacturing companies in China, this paper studies the impact of the degree of internationalization of enterprises on innovation ability [4]. The results show that the higher the degree of internationalization is, the stronger the innovation ability of enterprises is, and investing in developed countries can better improve their innovation ability; the research shows that enterprises' R&D investment abroad is conducive to improving the innovation level of enterprises, and overseas innovation resources can be transferred to the parent company through overseas R&D institutions, so that the parent company can maintain a certain competitive advantage in the international market; taking the listed companies with overseas R&D institutions in the catalogue of overseas investment enterprises of the Ministry of Commerce as a sample, this paper discusses the impact of R&D internationalization of Chinese enterprises on innovation performance from the aspects of R&D capacity, human resources, technology absorption capacity, and so on. The research results show that there is a U-shaped relationship between international R&D intensity and innovation performance. No matter how the enterprise obtains innovative resources, its essence is to maintain competitive advantage and improve business performance; through empirical analysis, this paper studies the R&D investment and business performance of large enterprises in Sweden and France and finds that the business performance of enterprises in these two countries has been significantly improved after increasing R&D investment [5].

3. Multiobjective Clustering Algorithm Based on Differential Evolution

3.1. Multiobjective Differential Evolution Clustering Algorithm. The algorithm flow of multiobjective clustering algorithm based on differential evolution is shown in formula (1) and Figure 1. The goal of the algorithm is to obtain the clustering results corresponding to all the clustering numbers K in the given range $[K_{\min}, K_{\max}]$, and $K_{\max}$ and $K_{\min}$ are the upper and lower bounds of the clustering numbers given by the user, so as to generate the Pareto optimal solution set of two optimization objectives—minimizing the clustering number K and the sum of the square distance in the class and SSD. The calculation method of the two objectives is shown as

$$f_1 = SSD = \sum_{k=1}^{K^*} \sum_{x_i \in C_k} \text{distance}(x_i, c_k)^2, \tag{1}$$

$$f_2 = K^*. \tag{2}$$

Among them, K^* is the effective cluster number represented by chromosomes, and c_k is the center of class C_k. The calculation method of class center is shown as

$$c_k = \frac{1}{|C_k|} \sum_{x_i \in C_k} x_i. \tag{3}$$

In this paper, Euclidean distance is used to calculate the distance between points. Clustering classifies each data point into the nearest cluster, and the distance between the data point and the class is calculated according to the distance from the data point to the center of the class [6].

3.1.1. Initialization Processing. In this paper, the clustering center is coded by real number coding. For the specific coding method, please refer to Figure 2.

The chromosome length is unified as

$$n = d \cdot K_{\max}, \tag{4}$$

where d is the dimension of the data point, the first d elements are the location coordinates of the first cluster center, the next d elements are the location coordinates of the second cluster center, and so on. Among them, each chromosome individual is randomly assigned an integer K^* in $[K_{\min}, K_{\max}]$ as the real cluster number, indicating that only the first $d \cdot K_{\max}$ elements in the current chromosome are the coding of the real and effective cluster center of the individual. The size of elite set E is $(K_{\max} - K_{\min} + 1)$, which is used to save the individuals corresponding to the optimal solution of each clustering number K in all the generated clustering solutions so far. During initialization, all individuals corresponding to different K in population P are found, and the individual with the smallest SSD value is selected as the optimal individual of the cluster number K and saved in E.

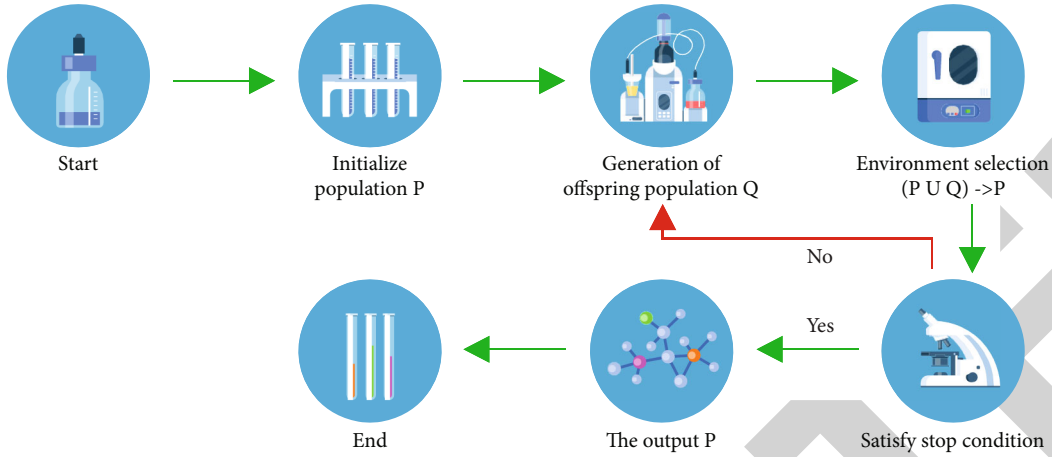


Figure 1: Multiobjective clustering algorithm of differential evolution.

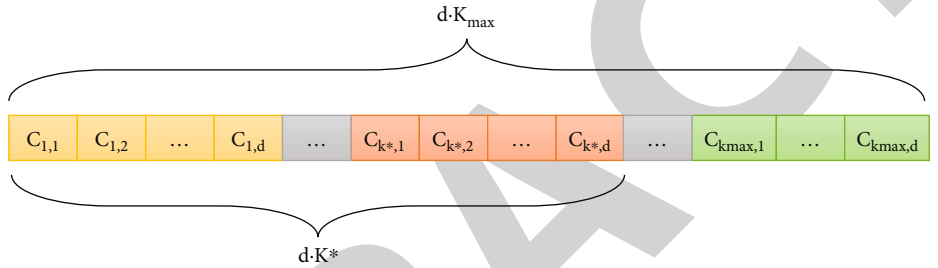


Figure 2: Schematic diagram of chromosome coding.

3.1.2. Reorganization and Selection. First, generate a mutation vector v_i according to formula (5), and x_i is the i-th individual in the mating pool to be operated, that is, the target vector. x_{best} is the historically optimal individual with the same clustering number K^* as x_i, that is, the individual corresponding to K^* in E. r_1 and r_2 are two integers randomly selected from $[1, N]$ that are different from i and different from each other [7]. The value range of user-defined scaling factor F is (0,2].

$$v_i = x_i + F \cdot (x_{\text{best}} - x_i) + F \cdot (x_{r1} - x_{r2}). \tag{5}$$

After mutation, cross the elements of the target vector and the mutation vector, as shown in formula (8), and generate a trial vector:

$$u_i = (u_{i,1}, u_{i,2}, \cdots, u_{i,n}), \tag{6}$$

$$n = K_{\max} \cdot d, \tag{7}$$

$$u_{i,j} = \begin{cases} v_{i,j}, & \text{if rand}_j < \text{CR} \quad \text{or} \quad j = j_{\text{rand}}, \\ x_{i,j}, & \text{otherwise}, \\ j = 1, 2, \cdots, n, \end{cases} \tag{8}$$

where CR is a random number in the range of 0 to 1 generated by user-defined crossover probability rand_j at different j, and j_{rand} is a random integer in the range of $[1, n]$, which is used to ensure that u_i and x_i are at least one bit different.

3.1.3. Check and Fill. The main idea of generating new individuals is merging and splitting. Many literatures show that this method can improve the quality of clustering results. After supplementing the clustering solution corresponding to the missing K, a new species group P is generated, whose size is not fixed but not less than N. The dispersion degree of each class is measured by the mean value of the sum of square distances from all data points in the class to the cluster center, that is

$$\text{Sep}(C_k) = \frac{1}{|c_k|} \sum_{x_i \in c_k} \text{distance}(x_i, c_k)^2. \tag{9}$$

The distance between classes is measured by the Euclidean distance between cluster centers, that is, the distance between classes C_i and C_j is

$$\text{distance}(C_i, C_j) = \text{distance}(c_i, c_j) = \text{sprt}\left(\sum_{t=1}^{d} (c_{i,t}, c_{j,t})^2\right). \tag{10}$$

Select the most dispersed cluster in the cluster, take the data point farthest from the cluster center and the data point nearest to the cluster center in the cluster as the new cluster center, delete the initial center of the class, and redivide the remaining data points in the cluster according to the two newly generated cluster centers [8]. After updating the

Table 1: Characteristics of datasets used in the experiment.

Serial number	Dataset	Number of samples	Dimension	Number of clusters (k)
1	spherical43	400	3	4
2	Spherical5	250	3	4
3	Spherical6	300	2	5
4	square1	1000	2	6
5	square4	1000	2	3
6	Diamond9	3000	2	9
7	2d-20c	1519	2	19
8	10d-10c	3054	10	10
9	10d-4c-no0	1288	10	3
10	10d-4c-no1	953	10	3

Table 2: Running time of each clustering algorithm on different datasets (s).

Dataset	GKA	MOKGA	EMO-KC	Proposed
spherical43	64.21	30.31	4.73	15.43
Spherical5	45.12	26.88	3.32	14.21
Spherical6	53.77	26.03	4.15	15.13
square1	106.32	30.74	3.76	12.29
square4	106.47	34.52	3.81	12.79
Diamond9	156.77	44.32	5.86	17.43
2d-20c	295.02	88.98	7.81	31.43
10d-10c	861.83	287.63	29.11	100.21
10d-4c-no0	394.32	165.33	20.06	53.71
10d-4c-no1	302.27	138.09	18.53	50.55

cluster center with one-step K-means method, the new cluster center is reencoded into the chromosome, and a new individual is generated according to this.

3.1.4. Time Complexity. In each iteration, the running time of the algorithm mainly includes two parts. The first part is used for environment selection. The time complexity of fast nondominated sorting and congestion calculation is $O(mN^2)$; the second part is used to calculate the optimization objectives of individuals and divide clusters. The time complexity is $O(NN_{\text{data}}K_{\max}d)$, where m is the target number of optimization, N is the number of individuals in the population, N_{data} is the number of data points in the dataset, $K_{\max}$ is the maximum number of clusters, and d is the dimension of data points [9]. Therefore, when the number of iterations of the algorithm is G, the total time complexity of the algorithm is

$$O\left(G \cdot \left(mN^2 + NN_{\text{data}}K_{\max}d\right)\right). \tag{11}$$

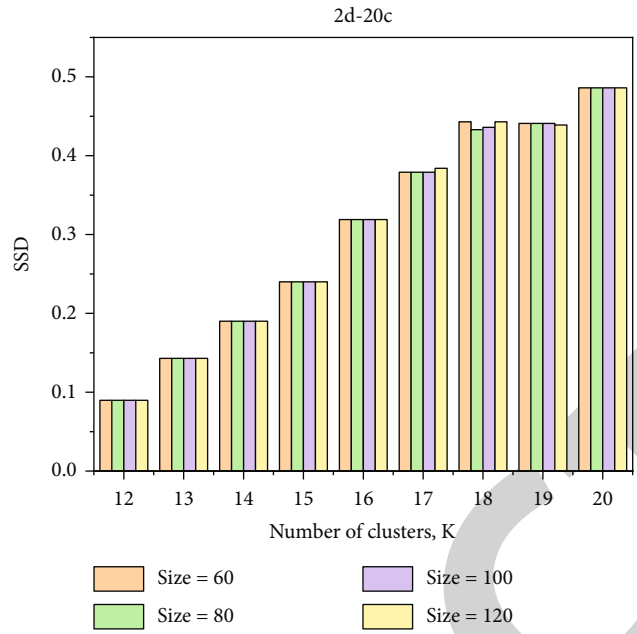
3.2. Analysis of Experimental Results. The value range of clustering number k in the experimental part is set as [2, 10], and the population size $N = 80$. The crossover probability CR of the algorithm proposed in this chapter is 0.9, and the scaling factor F is 0.9. Other parameters in algorithms GKA, EMO-KC, and MOKGA use the values recommended in their original texts. GKA, MOKGA, and the proposed algorithm are implemented with matlabr2016a, and the code of EMO-KC is obtained from the original author. The experiment was carried out on Win10 operating system with Intel® Core™ i5-8265U, 1.80 GHz CPU, and 8GB ram. See Table 1 for details of all datasets.

The adjusted Rand index (ARI) and clustering accuracy (CA) are used as evaluation indicators, and the calculation method is shown in equations (12) and (13). ARI evaluates the performance of the algorithm by counting the number of sample pairs that make correct decisions, and Ca evaluates the clustering accuracy by comparing the consistency between the predicted results and the real results. The value range of the two indicators is [0,1]. The larger the value, the better the clustering effect [11].

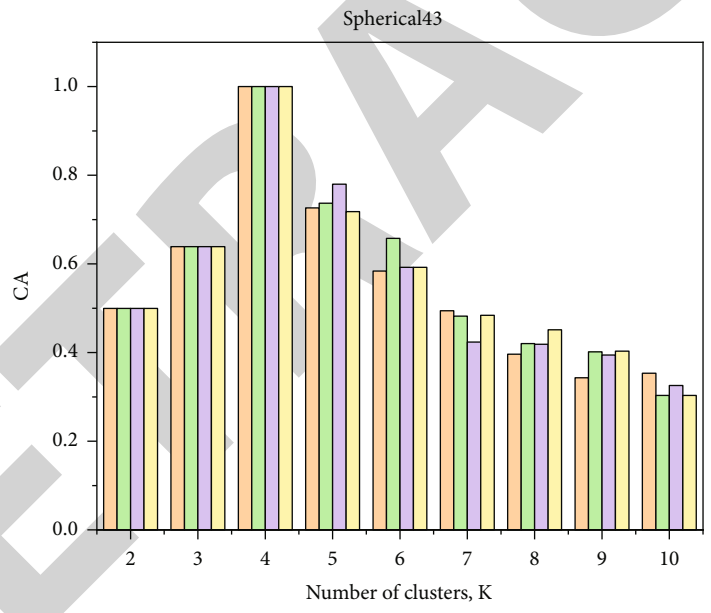
$$\text{ARI}(U, V) = \frac{\sum_{lk}\binom{nlk}{2} - \left[\sum_{l}\binom{nl.}{2} \cdot \sum_{k}\binom{n.k}{2}\right]/\binom{n}{2}}{(1/2)\left[\sum_{l}\binom{nl.}{2} + \sum_{k}\binom{n.k}{2}\right] - \left[\sum_{l}\binom{nl.}{2} \cdot \sum_{k}\binom{n.k}{2}\right]/\binom{n}{2}}, \tag{12}$$

$$\text{CA} = \frac{\sum_{i=1}^{K} a_i}{n}. \tag{13}$$

Table 2 shows that GKA takes more time than our algorithm in the case of the same or even fewer iterations, because GKA needs to run once to obtain the clustering



(a)



(b)

Figure 3: Continued.

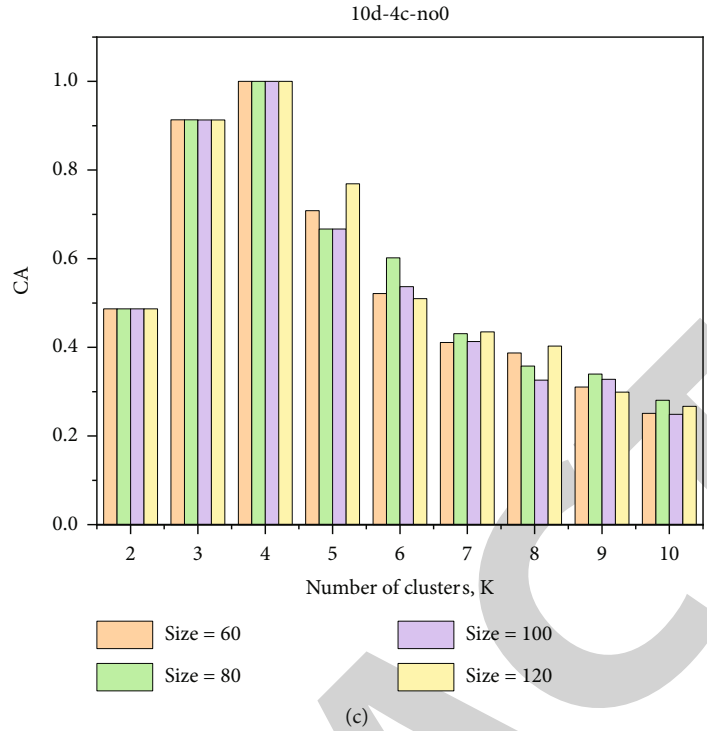


Figure 3: The accuracy of clustering results obtained by the proposed algorithm under different cluster numbers when setting different population sizes on datasets (a) 2d-20c, (b) spherical43, and (c) 10d-4c-no0.

solution of each k, and the distance calculation in the mutation is very time-consuming, especially when the dataset contains a large number of samples or the sample dimension is very high; each iteration will take a lot of time. For example, the dataset spherical43 contains 400 sample points, and the dimension of the sample points is 3. At this time, the running time of GKA is about four times that of the proposed algorithm. When the number of sample points increases to 1289 and the dimension is 10, such as dataset 10d-4c-no0, the running time of GKA is about eight times that of the proposed algorithm.

We evaluate the effect of population size on algorithm performance. The population size is set as 60, 80, 100 and 120, respectively. Figures 3(a)–3(c) give their respective results. It can be seen that no population size is absolutely superior to other set values [12]. The reason may be that the basis of the algorithm proposed in this chapter is K-means, and the optimization goal is to minimize SSD. Therefore, when the clustering number k is the same and the clustering converges to the global optimization, different population sizes have little impact on the performance of the algorithm.

Then we test the influence of the combination of different crossover probability Cr and scaling factor F on the algorithm. The value of Cr is taken from {0.3,0.6,0.9}, and F is taken from {0.3,0.9,1.5}. There are a total of 9 different combinations. Table 3 shows the average clustering accuracy of the results returned by the algorithm for dataset 2d-20c under these combinations [13]. It can be observed that the results of different combinations are similar regardless of the values of Cr and F. Therefore, it can be deduced that our algorithm has certain robustness to parameters.

4. Current Situation of R&D and Innovation Working Mechanism of Traditional Chinese Medicine Enterprises

Take the HD company as an example.

4.1. Enterprise Development Strategy

4.1.1. The Fourth Three-Year Plan for 2012-2015. The fourth three-year plan for 2012-2015 of HD pharmaceutical company consists of ten parts, and the main contents are shown in Table 4.

4.1.2. The Fifth Three-Year Plan 2016-2018. At the end of 2015, new changes have taken place in the policy and market situation faced by HD pharmaceutical company, and the state's control over drug prices will continue to compress the profit space of the enterprise; paying attention to the quality of drugs will raise the threshold of new drug registration and application, and the quality consistency evaluation will reshape the competitive circle of pharmaceutical enterprises; the regulation of pharmaceutical purchase and sale behavior will affect the marketing pattern and optimize the industry ecology. This series of changes will promote the pharmaceutical industry to develop in a more centralized and compliant direction [14]. In this context, the company's fifth three-year plan has seven parts, and the main contents are shown in Table 5.

After more than 20 years of development, HD pharmaceutical company is now a leading pharmaceutical enterprise in Zhejiang Province. Although it continues to have a high

Table 3: The average accuracy of the clustering results of each clustering number k obtained by the proposed algorithm on the dataset 2d-20c with different combinations of crossover probability Cr and scaling factor F.

CR	F	$K = 12$	$K = 13$	$K = 14$	$K = 15$	$K = 16$	$K = 17$	$K = 18$	$K = 19$	$K = 20$
0.3	0.3	0.578	0.641	0.711	0.794	0.853	0.901	0.931	0.963	0.963
0.3	0.9	0.573	0.641	0.711	0.805	0.851	0.896	0.923	0.929	0.929
0.3	1.5	0.571	0.641	0.711	0.805	0.851	0.883	0.913	0.916	0.922
0.6	0.3	0.577	0.643	0.703	0.789	0.851	0.891	0.932	0.957	0.959
0.6	0.9	0.578	0.645	0.725	0.801	0.848	0.883	0.915	0.916	0.931
0.6	1.5	0.591	0.643	0.711	0.775	0.837	0.854	0.876	0.903	0.925
0.9	0.3	0.583	0.641	0.707	0.806	0.841	0.886	0.923	0.953	0.928
0.9	0.9	0.577	0.639	0.711	0.804	0.847	0.886	0.922	0.946	0.949

Table 4: Development plan for 2013-2015.

Development plan of HD pharmaceutical company from 2013 to 2015	
1	Analysis of enterprise operation status
2	Overall development objectives and strategic positioning of the enterprise
3	Specific development ideas
4	Strategies to achieve sales growth
5	Product R&D planning
6	Innovation project planning
7	Human resources development planning
8	Production quality management planning
9	Fund plan
10	Business income and profit planning from 2013 to 2015

Table 5: Development plan from 2016 to 2018.

Development plan of HD pharmaceutical company from 2016 to 2018	
1	Marketing management and government affairs
2	Research and development of new products and technological innovation
3	Quality assurance
4	Production planning and production cost control
5	Human resource planning
6	Information construction
7	Financial management planning

profit margin and high growth rate, looking at China, it still can only linger in the second tier and cannot be among the first tier of domestic medicine in a short time [15]. The root cause is the lack of follow-up of new drugs (innovative drugs), and the long-term prospects are worrying. Such a situation is closely related to the importance that enterprises attach to the research and development of new drugs and capital investment for a long time. Hengrui Pharmaceutical's enterprise development process is very similar to HD pharmaceutical company. As can be seen from Table 6, the financial data of the two sides did not differ much around 2000. Now, the sales of the two companies have reached the level of 10 billion, and the sales revenue and net profit of Hengrui are more than twice that of HD pharmaceutical company [16]. What provides such a strong driving force for the development of Hengrui pharmaceutical, the most important reason is the gap between the two companies in the research and development of new drugs. Next, through the analysis of the annual reports of the two companies and relevant enterprise reports, the following comparison is made.

4.2. Internal Questionnaire Survey on the Current Situation of the Company's R&D Innovation System. The sample of this study is from all staff of HD pharmaceutical company. Data collection was carried out through the Association for science and technology of the company and the labor union. 1000 questionnaires were distributed by random sampling, and a total of 535 valid questionnaires were collected. Among the 535 questionnaires, 93.8% were related to R&D and innovation, and the average age of the sample was 32.8 years old (standard deviation = 8.23). The purpose of reliability analysis is to ensure the accuracy and reliability of questionnaire measurement. It reflects the consistency of the results obtained after repeated measurement of the same object with the same method. The level of reliability is usually judged by a coefficient. Generally speaking, $a > 0.7$ means that the reliability of the questionnaire is high, and $0.6 > a > 0.7$ is also an acceptable range [17]. If $a < 0.6$, it means that the reliability of the questionnaire is low and needs to be revised. In this paper, spss20.0 is used to analyze the reliability of each dimension in the questionnaire. The analysis results are shown in Table 7:

It can be seen from Table 7 that the Cronbach's alpha coefficients of the five variables in this study are greater than 0.8, which fully shows that the reliability of the questionnaire in this study is high, the sample answers are accurate and reliable, and the next step of statistical analysis can be carried out.

Analysis of the basic situation of the respondents. From 535 valid questionnaires, it can be seen from Figures 4 and 5 that the respondents cover different business types such as R&D, functions, production, and marketing, as well as different positions of leaders and ordinary employees [18].

Overall data analysis of survey results. As can be seen from Figure 6, from the distribution of scoring results, the

Table 6: Comparison of financial data.

Particular year	HD medicine	Hengrui medicine
2000	Sales 3.2, net profit 0.4	Sales 4.82, net profit 0.66
2018	Sales 82.29, net profit 18.3	Sales 173.99, net profit 40.42

Table 7: Reliability analysis of measurement scale.

Variable name	Cronbach's alpha	Number of problem items
Strategy	0.810	11
Organization	0.826	9
Culture	0.805	8
System	0.822	11
Technology	0.812	22

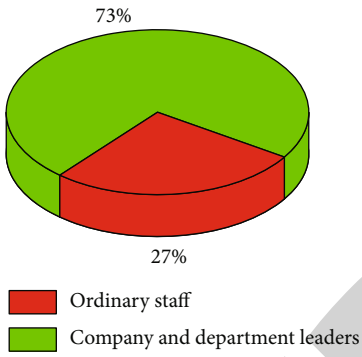


Figure 4: Distribution of survey sample structure by job position.

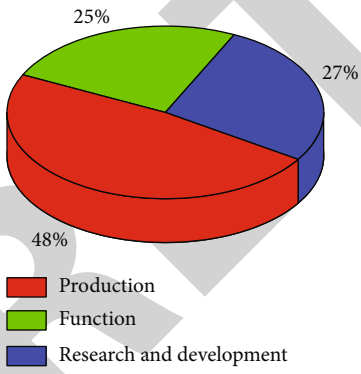


Figure 5: Distribution of survey sample structure by business type.

survey results are relatively objective; the overall average score is 3.5 points, which shows that although there are many problems in the overall scientific and technological innovation work, there are also positive points.

Score of each part. As can be seen from Figure 7, the main problems are as follows: the score of innovation culture is low; the score of R&D strategy and technology is relatively good.

The main problem is the index with low score. As can be seen from Table 8, the prominent problems are as follows: the company's R&D strategy is not clear; the existing innovation path of the company cannot meet the needs of enterprise development; the transformation of R&D achievements into production is too slow.

Investigation of open-ended questions. As shown in Tables 9 and 10, we can see the results of the investigation on the two open-ended questions "the most prominent problems restricting the scientific and technological innovation of our unit" and "the scientific and technological innovation support provided by the company is most needed at present" [19].

From the above survey results, we can see that the R&D innovation system of HD pharmaceutical company mainly has two aspects: (1) the R&D technology is inconsistent with the structure and scale of products. More than half of the R&D personnel are concentrated in Hangzhou; some pharmaceutical and other fields have formed domestic first-class R&D teams; some pharmaceutical R&D teams have a high starting point but lack high-level R&D talents. They obviously lack innovative knowledge and creativity in R&D cooperation with international pharmaceutical enterprises [20]. (2) The shortcomings of application-oriented technology improvement and sales strategy support are prominent. The terminal market sales capacity of differentiated goods is weak, and the market development of new products is slow. Pay attention to online technology development and ignore application technology development. Application technology development requires the establishment of a research and development team with compound knowledge structure.

4.3. Innovative Ideas for the Working Mechanism of the International Development of Traditional Chinese Medicine

4.3.1. Internationalization Strategy Should Be Based on Technology Orientation. Due to the uniqueness of pharmaceutical products, the product development cycle is long, the investment cost is high, and the technical difficulty is great. The cycle of evaluation of traditional Chinese medicine by international professional institutions is too long, and the cost of capital consumption is too high. It takes several years from the application of drugs to the evaluation results. After consuming a lot of resources and costs, the final results of Chinese pharmaceutical enterprises are often unsatisfactory [10]. This restriction from market authorities is essentially a technical test of the safety and stability of drugs in China, and technological innovation is also lacking in most pharmaceutical enterprises in China. The decision-making of R&D investment should be based on the future technology development trend and enhance the long-term value of the enterprise, and return to the long-term demand level, so as to meet the concept hype of investor sentiment,

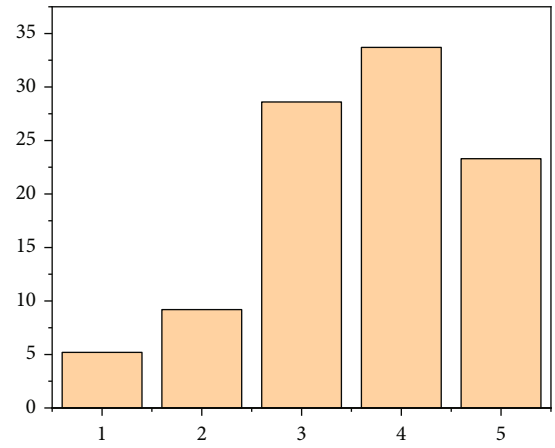


Figure 6: Distribution of problem scoring results.

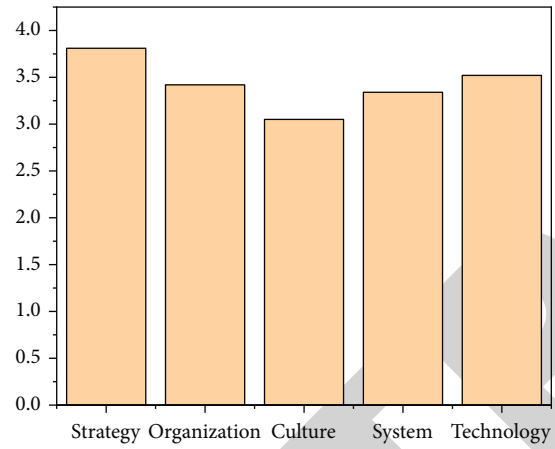


Figure 7: Average score of each article.

and "telling stories" can only bring short-term effects. Technology-oriented strategy plays a stronger role in international R&D.

Therefore, when carrying out the internationalization strategy, Chinese pharmaceutical enterprises should take technology orientation as the principle and improve the long-term value and international competitiveness of enterprises by absorbing and learning overseas advanced technology. Combined with the international cases of some pharmaceutical companies, Chinese enterprises can learn from the experience of international cooperative research and development of Compound Danshen dropping pills; cooperate with overseas high-tech enterprises or scientific research institutions in many aspects, such as drug safety, efficacy evaluation, drug development, and technological improvement; and use their advanced resources and technological advantages to help Chinese enterprises solve the difficulties in new drug research and development and certification. While promoting the R&D and technological progress of traditional Chinese medicine in China, it has shared the high R&D costs and risks of R&D activities, and it can better introduce advanced technologies into China through cooperation, promote its own R&D, and finally lead traditional Chinese medicine to the international market [21].

Due to the huge capital consumption of international certification and R&D investment, as well as related investment and construction projects, enterprises often face high financial risks in this process. Therefore, when carrying out R&D activities, enterprises should pay attention to whether there are smooth financing channels and seek government subsidies to supplement liquidity. Through the comparison of the two-stage internationalization mode of Tianshili, it is found that the financial performance during the "inward" internationalization period is due to the "outward" internationalization stage, and the financing constraints are smaller, and the degree of capital guarantee is higher. Internationalization, as a regulating factor between R&D innovation and financing constraints, enterprises should carry out international layout according to their own funds, so as to find a balance between R&D innovation and financing constraints.

4.3.2. The State Strengthens Policy Guidance. Although R&D activities can contribute to the competitiveness of enterprises in the long run, R&D activities of enterprises need to consume a lot of funds, and the uncertainty of R&D results increases the risk of R&D activities of enterprises. Therefore, when making investment decisions, enterprises are often willing to invest funds in marketing activities that promote the market revenue of enterprises in the short term, which is short-sighted to a certain extent. On the other hand, international certification of pharmaceutical products also requires a lot of resources, and the certification cycle is long. Some high-quality enterprises are often unable to obtain continuous financial support due to their own capital constraints, that is, internal financing constraints, and are deterred from product internationalization. For external fund providers, due to the high uncertainty and long R&D cycle of pharmaceutical products, they will require higher risk compensation or avoid investment and borrowing, which leads to the external financing constraints of Chinese pharmaceutical enterprises. As an external promotion means to support enterprise innovation activities, the government subsidy policy for high-tech industries of enterprises has been proved by a large number of studies to be one of the important factors of their R&D and innovation investment and achievements.

The policies that the government supports and promotes enterprises to invest in internationalization and innovation are divided into two categories: one is fiscal incentive, which refers to the incentive policies in the fiscal and tax system; the second is financial incentives, which refers to the way to support R&D and innovation projects through direct subsidies or preferential loans. Britain, the United States, India and other countries have formulated a wide range of preferential policies to promote the R&D and innovation of domestic enterprises. Therefore, China's traditional Chinese medicine enterprises are currently in an important stage of innovation catch-up. The state should formulate corresponding incentive policies to guide the business decision-making direction of enterprises, so as to promote the R&D and innovation input and output of enterprises.

Table 8: Indicators with the lowest average score.

Serial number	Lowest index of average score	Average
1	Does the company have a clear R&D and technology strategy?	2.03
2	Can the company's existing innovation model meet the needs of enterprise development?	2.11
3	Is the speed at which R&D achievements are transformed into production fast?	2.55
4	Can the company effectively follow up and motivate the progress of the project?	2.87
5	Does the company attach importance to the improvement of online product technology?	3.01

Table 9: List of votes obtained for open-ended question 1.

	Survey topic	Vote rate
What do you think is the most prominent problem restricting the scientific and technological innovation of this unit?	Insufficient innovation ability and resources	21%
	Lack of effective innovation incentive mechanism	17%
	Insufficient coordination of R&D, production, and marketing	13%
	The team construction of innovators is backward	14%

Table 10: Open question 2 question sorting.

Survey topic	
Do you think the company's scientific and technological innovation support is most needed at present?	Project management: the project initiation is still mainly proposed by R&D personnel, and the demonstration of market and intellectual property rights is not deep enough Talent team: lack of discipline leaders with international vision, uneven R&D technology team, weak industrialization technology team, and accelerated loss of young employees

Firstly, the Chinese government should develop a certain degree of continuity, including tax incentives and research program funding. Due to the lag between the input and output of R&D activities, government subsidies to enterprises often need to be effective in the subsequent period of time. From the perspective of the results of preferential policies on Enterprise R&D, the long-term promotion effect of preferential policies formulated by the government on Enterprise R&D activities is more obvious than that in the short term. Therefore, the preferential treatment and funding of government agencies for R&D and innovation of enterprises should be continuous, so as to help enterprises improve their R&D capabilities and finally achieve R&D results.

Secondly, the government's financial incentive policy should be selective. At present, only a few traditional Chinese medicine ingredients have been recognized internationally, while most Chinese medicine enterprises in China have weak R&D strength and insufficient innovation investment. Our government should first focus on supporting traditional Chinese medicine enterprises with international influence and competitiveness, help Chinese medicine enterprises to open up the international market, and finally promote the internationalization process of Chinese medicine industry.

4.3.3. Innovative Enterprise Product R&D Innovation Platform Design. Closely focus on the construction goal of innovative enterprises of pharmaceutical enterprises and promote the quality and efficiency improvement, transformation, and upgrading of traditional pharmaceutical manufacturing industry; take exploring the innovation of incentive mechanism as a breakthrough, stimulate the enthusiasm of employees for innovation and entrepreneurship, cultivate innovation culture, and realize the new situation of the company's transformation to innovative pharmaceutical enterprises.

(1) Synthesis Technology Platform: A First-Class Green Synthesis and Efficient Purification Technology Platform. The technological soft value of the synthetic technology platform is reflected in the rapid technological transformation ability of generic drugs and innovative drugs and the technological upgrading ability of products. It is committed to the development of small-scale process of R&D products, the development and application of green chemical synthesis technology, pilot scale-up and industrialized production, through the construction of five professional fields of small molecule drug process hazard analysis, impurity research, drug crystal form research, green synthesis, and industrialization. Strengthen the introduction and application of advanced technology, realize the green synthesis of small molecule drugs, form independent intellectual property technology in many project areas, speed up the transfer of projects, and strive to build a domestic first-class green synthesis and efficient purification sharing technology platform.

(2) Quality Technology Platform: A First-Class Technology Platform for Drug Quality Research Capability. The quality technology platform is committed to establishing scientific drug analysis methods, establishing complete and appropriate drug quality standards, truly reflecting drug quality, accurately and timely completing the analysis and testing of R&D samples, and relying on a reliable internal control system to ensure the authenticity and effectiveness of data. At present, the platform has many international projects of innovative drugs and generic drugs under research and development and has rich experience in the development of analytical methods, forming the core competence of the department in the analysis and research of drug impurities. It has relatively comprehensive research capabilities in impurity structure analysis, influencing factor research, analytical method development, limit research, etc. In the future, the platform will focus on developing comprehensive research capabilities in chemistry and analysis of genotoxic impurities. In addition, through the development of macromolecule and polypeptide projects, we will focus on the research on the characteristics of macromolecule and polypeptide projects in the future and strive to have the ability to complete the quality research of macromolecule and polypeptide projects within three years, so as to match the development requirements of the company in the field of biological similar drugs.

(3) Technology Management Department: Efficient Technology Platform Resource Integration Capability. As a functional management department under the scientific research center, the technology management department provides technical support in domestic registration, domestic registration compliance, pharmaceutical regulations, R&D budget management, R&D equipment management, project application, etc. It is mainly responsible for the registration and application of projects, focusing on the interpretation of laws and policies, and providing legal guidance for the R&D process of scientific research projects; investigate the market situation, original research situation, patent information, technological innovation points, and other information of scientific research projects, and provide information sources and support for scientific research direction; manage the R&D projects of the scientific research center, coordinate the resources of all parties, and do a good job in the integration, allocation, and control of scientific research resources according to the R&D of new products and the preparation of pilot clinical samples, so as to ensure the compliance, efficient, and orderly development of the project. The goal is to build a communication bridge for the five platforms of the scientific research center and other relevant departments and establish a working mechanism of good cooperation and common development, so as to ensure the scientific and efficient development of scientific research projects.

5. Conclusion

Today, with the increasing internationalization risks, innovation and R&D have increasingly become the key for enterprises to maintain their core competitiveness in the complex and volatile international market. China has always attached great importance to the international development of Chinese high-tech enterprises. Traditional Chinese medicine enterprises are high-tech enterprises with unique Chinese characteristics. While promoting people's livelihood, they also shoulder the task of spreading China's traditional Chinese medicine culture. Since the reform and opening up, China has attached importance to the development of the traditional Chinese medicine industry and provided multilevel policy support to provide a strong environment for its development. The innovation of the pharmaceutical industry is more important in this environment, especially in the context of internationalization. In order to carry out international competition, we must pay attention to the innovation and upgrading of the working mechanism. On the basis of clarifying the specific optimization strategy, we should fully improve the innovation management theory, strictly grasp the management construction of the company, and optimize and improve its management strategy through more novel thinking.

Data Availability

The dataset can be accessed upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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