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Innovative Development Measures of the Chinese Medicine Industry in Industrial Big Data with the Aid of AI in the Context of an Imperfectly Competitive Market Economy

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ABSTRACT

The use of traditional Chinese medicine for healthcare has been on the rise in recent years, leading to the rapid development of the industry in China. However, the industry still faces several challenges, including the supply of raw materials, changing market demands, and competition from foreign competitors, especially during the current era of rampant epidemics. To address these challenges, advanced technologies such as artificial intelligence (AI) can play a significant role in enhancing the innovation and competitiveness of the Chinese medicine industry. One such technology is the Long Short-Term Memory (LSTM) algorithm, a recurrent neural network that has proven effective in processing and analyzing sequential data. By utilizing this algorithm, the Chinese medicine industry can harness the vast amounts of data generated during various stages of production, from raw material selection to clinical practice. This can optimize processes, improve product quality, and enhance treatment outcomes.

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Introduction

The Chinese medicine industry is an important part of our national health development, and in the new era of rapid economic development, the content of technology in the Chinese medicine industry is constantly improving, and many advanced technologies have been gradually put into use (Andrea, Louise, and Patricia 2022). Especially in the imperfectly competitive market economy, government intervention has enabled people to continuously enjoy better quality Chinese medicine services (Chiwei, Chang, and Ran). It has always been a key area of concern for scholars. But at present, the innovation of Chinese medicine industry in China is still in a bottleneck, according to the relevant survey, most of Chinese medicine industry in China still stays in the simple planting, harvesting and processing stage, and the research direction of many scholars is also limited to this, while some foreign scientists have shifted their attention to the biogenetic technology and purification technology

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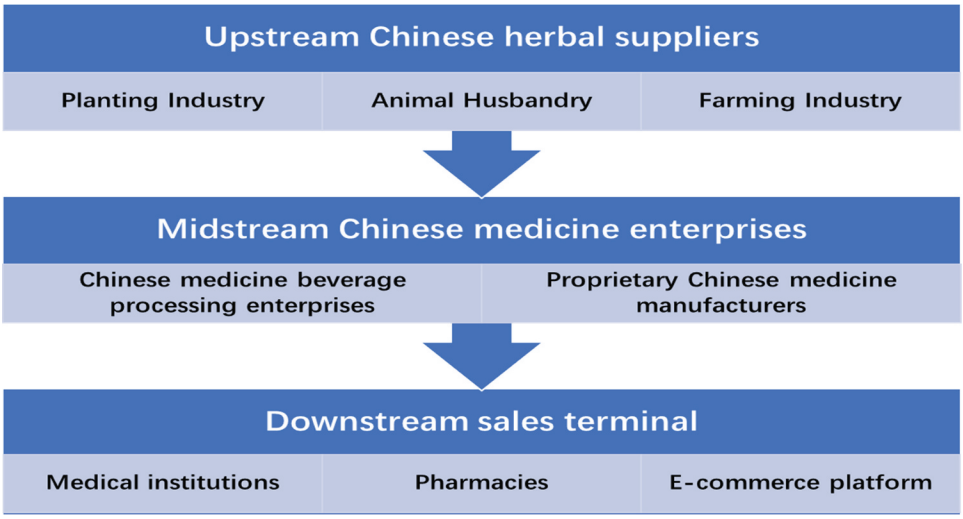

Figure 1. Main distribution of Chinese medicine industry.

behind Chinese medicine and are in the leading position, which still needs to be analyzed and considered by relevant departments and practitioners of Chinese medicine (Lattie, Adkins, and Winquist 2019). One of the main distributions of the Chinese medicine industry is shown in Figure 1.

And several common problems of innovation development in Chinese medicine industry are as follows.

(1) Problems of upstream industries. The upstream of the Chinese medicine industry is mainly various kinds of suppliers, who determine the source of the Chinese medicine industry and have an important role in both quality and quantity (Yan and Rosmini 2022). For example, in the planting and breeding industries, the nurturing and development of wild medicinal plant resources is the top priority (*U.S. Food Amp; Drug Administration Documents/*). 70% of the commonly used Chinese herbs still come from wild resources, and the remaining 30% rely on artificial breeding for supplementation (Eugene et al. 2022). The biggest problem is the destruction of the environment, including the overexploitation of resources, the reduction of ecological diversity and environmental pollution, which are devastating to the medicinal plant and animal resources, and many species have experienced large-scale population decay due to environmental damage, making it difficult to meet the sustainable demand of the Chinese medicine industry (V, Kumar, and P). At the same time, there are some technical problems that need to be faced by the upstream of Chinese medicine industry, such as the expansion of Chinese herbal medicine planting bases, cultivation and selection of excellent planting resources, improvement and

implementation of GAP management system, application of new technologies and methods such as tissue culture, fermentation engineering, molecular biology and synthetic biology, which have become the shackles of further innovation and development of Chinese medicine industry. This has become a shackle for further innovation and development of the Chinese medicine industry (Castellano and Aouina Mejri 2022).

(2) Problems of midstream industry. The problems of the midstream industry are mainly found in the processing enterprises related to various kinds of Chinese medicines. With the modernization of traditional Chinese medicine in recent years, the application of big data has gradually become popular, and more and more enterprises have started to devote themselves to the traditional Chinese medicine industry, developing and selling traditional Chinese medicine drinks, traditional Chinese medicine food, traditional Chinese medicine reagents and other related products. Therefore, the Chinese medicine industry has been a hot and highly profitable industry in recent years, but with it comes the high risk behind the high returns. The gradual rise in profits has brought about a crowded market, and a large number of other non-Chinese medicine enterprises have started to seek to switch to other industries, and blindly, which is a greater risk for the imperfectly competitive market, and government intervention coupled with the market mechanism, many enterprises have not gone far in the Chinese medicine industry, resulting in A lot of resources were wasted. At the same time, most of these companies' innovation paths lacked key technical support, simply copying and pasting popular TCM products already in the market without proper product development and innovation. This has a certain gap with some excellent TCM enterprises in other parts of the world, from the production concept to the operation mode. To the specific processing technology, there are still many areas that need innovation.

(3) Problems of downstream industries. When it comes to the downstream of the Chinese medicine industry, it is down to all kinds of sales terminals. Common sales terminals include medical institutions, pharmacies and e-commerce platforms, which are responsible for marketing TCM products to consumers. In the era of big data, the sales terminals have a more effective sales tool that allows them to use big data to pinpoint potential consumers and thus promote consumption. However, this also brings more intense market competition, especially for sales terminals in overseas markets, which are not controlled by the Chinese government and can sell corresponding products locally. Accordingly, the growth of China's exports of TCM products is not so obvious, and they are mainly engaged in the sales of some low-end

products, with a very small percentage of some high-value TCM products. According to statistics, the annual international market value of Chinese medicine products is nearly 20 billion yuan, and the top ranking countries are Japan, South Korea, Singapore and other Asian countries, and China's share is only 3%, which is much lower than other competitors. This is more related to the lack of relevant talents and technology in the process of Chinese medicine trade in China. Many sales terminals are obsessed with pursuing the sale of products, neglecting the necessary work of applying advanced technological tools and innovating marketing methods, and the training and reserve of excellent talents are not in place, making the process of innovation and transformation particularly difficult. The international trade share of the Chinese medicine industry mentioned above is shown in Figure 2.

After understanding the challenges related to the innovation and development of the Chinese medicine industry in industrial big data, this paper will use the tools of the system architecture of industrial big data and advanced technologies such as artificial intelligence (AI) algorithm, particularly LSTM algorithm, to explore the development of the Chinese medicine industry and find innovative solutions. In particular, AI algorithms can play a crucial role in analyzing and modeling complex data, allowing the Chinese medicine

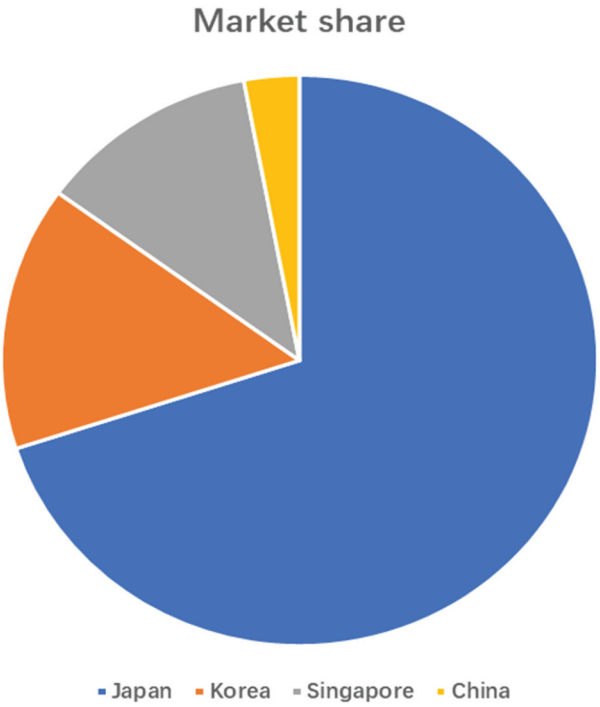

Figure 2. International trade share of Chinese medicine industry.

industry to leverage the vast amounts of data generated in various stages of production, from raw material selection to clinical practice.

LSTM is a type of recurrent neural network that is particularly well-suited for processing and analyzing sequential data, such as time-series or natural language processing. In the context of the Chinese medicine industry, LSTM can be used to analyze large amounts of data generated during various stages of production, from raw material selection to clinical practice.

Overall, using LSTM can help the Chinese medicine industry harness the vast amounts of data generated throughout the production process and use this data to optimize processes, improve product quality, and enhance treatment outcomes.

This approach can optimize processes, improve product quality, and enhance treatment outcomes, contributing to the advancement of traditional Chinese medicine practices.

While the use of AI in healthcare is not a new concept, the application of LSTM in the Chinese medicine industry is a novel approach that can bring significant benefits to the industry. The novelty of the study is the suggestion that advanced technologies such as artificial intelligence, specifically the LSTM algorithm, can play a significant role in enhancing the innovation and competitiveness of the Chinese medicine industry. The article highlights the challenges faced by the industry, including the supply of raw materials, changing market demands, and competition from foreign competitors. It proposes the use of AI as a solution to address these challenges. Specifically, the article focuses on the potential benefits of using LSTM in various stages of production, from raw material selection to clinical practice, to optimize processes, improve product quality, and enhance treatment outcomes.

In summary, this paper provides several key contributions. First, it visualizes and models the Chinese medicine industry, enabling a better understanding of the industry's current state and potential opportunities. Second, it utilizes industrial big data analysis and AI algorithms to identify key challenges and opportunities in the Chinese medicine industry, in line with the innovative thrust of this paper. Third, it proposes innovative solutions to the main problems currently faced by the Chinese medicine industry in China. Fourth, it provides a reference and guidance for the innovation and development of Chinese medicine enterprises, demonstrating the potential of AI algorithms in optimizing the industry's processes and promoting its competitiveness in the market.

Research Background

With the development of the information age, the application of industrial big data has become popular, and many market economies, including the Chinese medicine industry, have been involved in big data. At the same time, the speed

of information interaction has become faster and intensified the competition between markets. Under the imperfectly competitive market, many Chinese medicine enterprises are facing the problem of transformation and innovation, so the scholars' attention has been directed to the innovation aspect of Chinese medicine industry in recent years (Yang 2021).

In this paper, the literature review will be conducted according to the main directions of research, firstly, the research on "imperfectly competitive market economy," which is a common economic term in economics, but few scholars have conducted research specifically on this term, generally comparing it with perfectly competitive market and analyzing it from a macro perspective. It is usually compared with a perfectly competitive market and analyzed from a macroscopic point of view, in which the players and potential players in the market are analyzed and their states and market behavior are studied. The disadvantages of imperfect competition conditions, such as imbalance between supply and demand, waste of resources, etc., are also analyzed (Shaonan 2021). At the same time, some scholars also seek to maintain the market order from the point of view of securing the appropriate allocation of market mechanisms in production, exchange, consumption and distribution, and by extension, government intervention, so as to form a macroeconomic ecological environment.

The second is the research on "industrial big data." In the current information age, industrial big data is an important product of the new round of global industrial revolution. While the economy is going digital, industry is also gradually moving closer to digitalization, whether it is data-driven industrial intelligence or related industries based on big data, more and more new concepts are becoming familiar to people. There is also a wide variety of perspectives studied by scholars. Both the current situation and outlook of industrial data are studied from the whole general environment, from pre-processing, modeling.

The key aspects of data are analyzed in the process of pre-processing, modeling, application, etc. Frontier representatives such as deep learning are used as typical cases to highlight the benefits of data-driven industrial intelligence; there are also studies on the security issues of industrial big data, noting the security issues behind the rapid development of data while seeing it, conducting case studies on the development of new concepts such as cloud computing and the Internet of Things, analyzing the risks involved, and combining them with the trend of industrialization of data to propose corresponding preventive measures; and Others will implement the big data technology into the actual industrial industry, compare and analyze the development status of the industry before and after the application of big data from the subtle point of view, and take big data as the main variable to draw the final conclusion that big data will have relevant impact on industrial development, and at the same time make reasonable suggestions for the actual

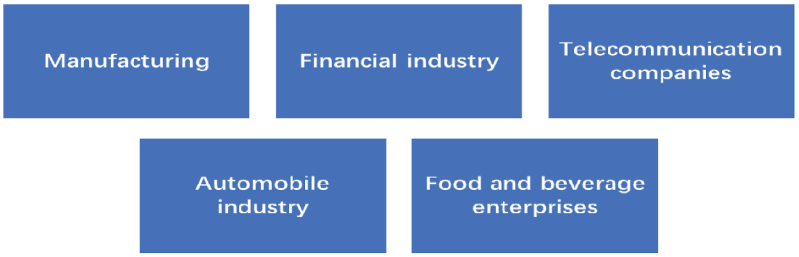

Figure 3. Common industries applying industrial big data.

industrial data according to the conclusion, so as to realize the vision of data The vision of promoting industrial development. The common industries that apply industrial big data are shown in Figure 3.

Another research is about "innovation in Chinese medicine industry." Again, this is also a common research topic in academia in recent years. The Chinese medicine industry has been developed for a long time, and has been leading a big or small wave at different times. And in the modern society with highly developed information, the attention of the Chinese medicine industry has been maintained at a high level. Therefore scholars' research on the Chinese medicine industry has never been significantly stagnant. Some scholars will discuss the significance of innovation in Chinese medicine industry at the level of national strategy, try to form a Chinese medicine industry alliance suitable for our country compared with other developed countries, and reasonably construct a game model between different countries. Some scholars also focus on certain regions, such as Xinjiang and Fuzhou, where the Chinese medicine industry has a strong foundation, to specifically study the problems encountered in the development of the local Chinese medicine industry and propose locally appropriate solutions. Other scholars will conduct innovation research in the TCM industry from a certain single technological perspective, using various tools such as statistical analysis methods to analyze the appropriate technological directions for innovation (Jurong, Lili, and Hua 2021).

The last is that among the studies on the combination of the above three as far as possible, no scholars have yet conducted research specifically on the development of innovation in the Chinese medicine industry in the context of industrial big data in the context of imperfect competition. It is still mainly for the innovation of industrial big data or industrial industry alone, and not even the imperfectly competitive market economy has been paid much attention by scholars. Some scholars have then tried to combine the study of the Chinese medicine industry with other aspects of research and use digital algorithms to parse it (Jing 2021). For example, combining economic development with the TCM industry to study the impact of the new economic normalization on the TCM industry; or digital tooling to study the revival of TCM and other industries under industrial intelligence, properly compared with other

traditional enterprises to explore new developments (Yamin et al.). The focus of these studies has some similarities with the main idea of this paper, which can provide reference and reference for this study.

In summary, there is still a certain scale of research on the innovation and development of Chinese medicine industry, and most scholars can combine two of the key points together and carry out research by means of data statistics or model analysis. However, in the complete combination of the three, no scholars have yet launched a targeted research on this topic, therefore. The author will try to link these three together in this context to study the innovation of Chinese medicine industry in the new era from a new perspective.

Materials and Methods

Basic Theory

Big Data System of Chinese Medicine Industry

This paper uses a data system commonly used in the study of the Chinese medicine industry (Bastogne 2017). Similar big data systems are generally used for a large number of industrial studies. The data system will be different for different research scenarios, and for the innovative research on Chinese medicine in this paper, the system architecture in it needs to be adjusted appropriately, and by system architecture here, we mean that in this industrial big data system, there needs to be corresponding components and structures to address different needs. This requires the system itself to be adjustable and able to adapt to different levels of needs according to the background of imperfectly competitive market and the characteristics of the big data information era. After certain data analysis and examination, the big data structure of Chinese medicine industry in this paper can be split into three layers, in order of data flow: data integration layer, data analysis layer and application scenario layer. The data integration layer is the foundation and the source of data, storing the collected data and providing valuable data for subsequent research. The data analysis layer is the processing stage, applying the collected data to different models and using corresponding algorithms to give full play to the value of the data; finally, the application scenario layer, after the data analysis results, it also needs to be put into practice to ensure that the model analysis results can be perfectly applied to real life. In general, the whole system has a clear division of labor, from the beginning of the source-oriented to further processing and finally to the practical application, the value of the data is explored and transformed into reality step by step, with logic and wholeness. The specific structure of which is split can be seen in Figure 4 below.

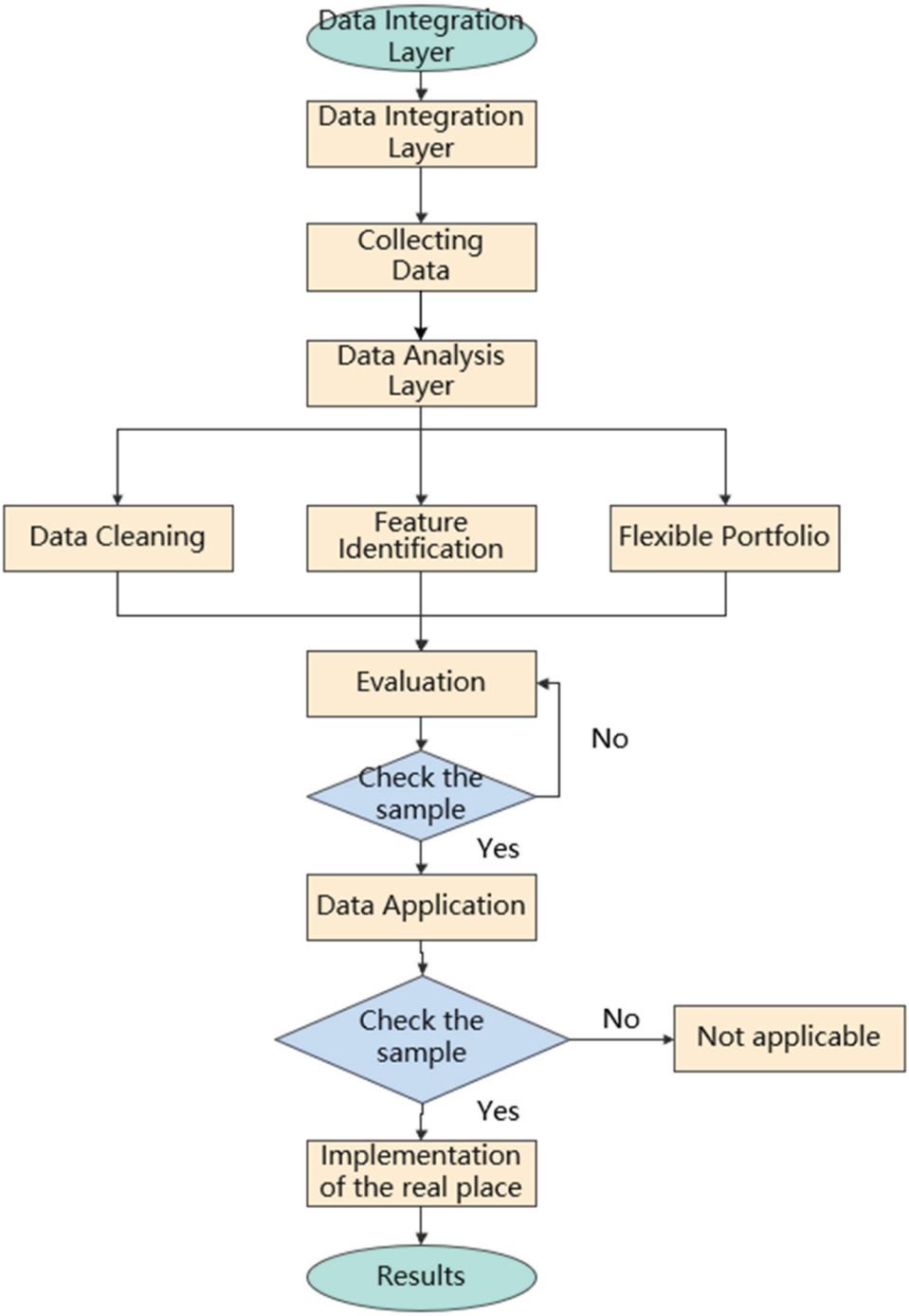

Figure 4. Big data system structure of Chinese medicine industry.

Methods for Embodying and Verifying the Results

In this paper, the big data system of Chinese medicine industry will be modeled based on the data, and the results calculated by the model will be analyzed whether the method can be applied in the process of Chinese medicine innovation. The validation results will be divided into pre-application and post-application of the model. Before application, the approximate accuracy of the whole model is simulated to determine whether it meets the requirements of the model. There are many ways to judge, and this paper uses two common ones, simple validation and cross-validation. The former will filter out two parts of data from the original data, substitute the data of one part into the other part for comparison, find out the part with errors, and so on to complete the overall data validation. The latter is divided into multiple parts, and each part is substituted into the other part once, so that the problematic parts can be found more accurately. The evaluation criteria for both validation methods generally use the mean variance used in regression analysis, and values that are too large are considered problematic and need to be rescreened (Z et al.). The validation of these specific data is used to make a high level of confidence in the calculated results of the model derived from the system.

Model Setting and Strategy Analysis

In order to better target the analysis of the big data system of Chinese medicine industry, the system architecture of this paper will still be three layers: the basic layer, the analysis layer and the application layer, and with the combination of the above-mentioned multiple methods of embodying and verifying the results, more accurate conclusions can be drawn, and there is no significant error with the use of Chinese medicine industry in reality. And the model uses the RTRT method with the following test formula:

$$DT = n + x1 \times Dc + x2 \times \%H - x3 \times \%H \times Dc \tag{1}$$

where n is a constant, $_{x1,}$ x2 $_{and}$ x3 $_{are}$ correlation coefficients, and the specific stratification is as follows.

Data Integration Layer

In terms of the source of data, the model applied in this time selects data from different sources in order to consider the diversity of calculation results. It contains not only data from commonly used industrial models and software, but also data from daily business operations such as corporate financial reports, market disclosures, etc. Specifically, this paper involves the following eight types of data: data collected by instruments and sensors at the Chinese medicine equipment layer (PAT), data generated by process control systems such as the Chinese medicine data acquisition and monitoring control system

(SCADA), advanced planning and scheduling system (APS) data, laboratory management system (LIMS) data from the quality department of TCM and enterprise resource management system (ERP) data from the TCM processing enterprise level (Borscheva et al.). Some of these data are of high confidentiality, so only a part of them are disclosed and the missing ones will be brought to the next step logically.

Data Analysis Layer

While processing the Chinese medicine industry data, this paper proposes to use the advanced artificial intelligence algorithm called Long Short-Term Memory (LSTM) to analyze and process data. LSTM is a recurrent neural network that can process sequential data, such as time-series data, and has been widely applied in various fields, including natural language processing, speech recognition, and image processing. LSTM algorithm can capture long-term dependencies and handle vanishing gradients, which makes it an ideal choice for processing complex and dynamic Chinese medicine industry data.

The LSTM algorithm is defined as follows:

First, the input gate is calculated by:

$$i_t = \text{sigmoid}(\text{W}_\text{i} * [\text{h}_{\text{t}-1}, \text{x}_\text{t}] + \text{b}_\text{i})$$

where i_t is the input gate at time t, h_{t-1} is the hidden state at time *t-1*, x_t is the input at time t, W_i and b_i are the weight and bias matrices, respectively, and sigmoid is the activation function.

Second, the forget gate is calculated by:

$$f_t = \text{sigmoid}(\text{W}_\text{f} * [\text{h}_{\text{t}-1}, \text{x}_\text{t}] + \text{b}_\text{f})$$

where f_t is the forget gate at time t, W_f and b_f are the weight and bias matrices, respectively.

Third, the output gate is calculated by:

$$o_t = \text{sigmoid}(\text{W}_\text{o} * [\text{h}_{\text{t}-1}, \text{x}_\text{t}] + \text{b}_\text{o})$$

where o_t is the output gate at time t, W_o and b_o are the weight and bias matrices, respectively.

Fourth, the cell state is updated by:

$$c_t = f_t * c_{t-1} + i_t * \tanh(\text{W}_c * [h_{t-1}, x_t] + b_c)$$

where c_t is the cell state at time t, tanh is the activation function, and W_c and b_c are the weight and bias matrices, respectively.

Finally, the hidden state is updated by:

$$h_t = o_t * \tanh(c_t)$$

where h_t is the hidden state at time t.

By using LSTM algorithm, this paper can effectively process and analyze the Chinese medicine industry data and provide valuable insights for the industry's development.

Application Scenario Layer

In the final data application stage, it is necessary to consider the life cycle of these Chinese medicine enterprises according to the actual scenarios of the sales terminals, and to apply the processed data into each model in different categories to judge whether the data set has practical application value. Failure and then need to go back to the previous process for reprocessing. In addition, when Chinese medicine companies make relevant product sales decisions, they can obtain useful references and suggestions from these data to make the optimal choice that best meets the overall interests.

Operational Platform

And a scientific and reasonable platform is essential to meet the above three stratifications of building. In large Chinese medicine enterprises, there is usually a special operation platform, and after building the Chinese medicine industrial big data system above, it is even more necessary to have a corresponding operation platform to escort it, including but not limited to a reasonable IE system, processor module, digital engine, mobile app, etc. The running platform also needs to take into account the interoperability and compatibility between data, prepare the coupling from the source, and set up the corresponding emergency treatment for data conflicts. The specific connection between each of these data layers and the operation platform is shown in Table 1.

Data Sources

When data collection is carried out, data screening needs to be carried out according to certain processes, including data preparation, data cleaning and data transformation. Data preparation requires selecting suitable parts from various sources of raw data and processing them in a predetermined format, which generally takes a long time to carry out a variety of collocation attempts and select data sets that are more relevant to the research system of Chinese medicine in this paper. And after the selection, data cleaning is also needed to remove the data sets with abnormal items such as missing, errors and duplicates, among which the phenomenon of missing is the most frequent, accounting for nearly 50%. The percentage of errors and duplicates are close to each other, accounting for about 25%. The cleaning method applied in this paper is the Dynamic Time Warping (DTW) smoothing method, which fills in the vacant parts and replaces the duplicated and erroneous data in time. The last thing is to transform the data into the form required by the model. The TCM data required in this paper is in the form of a table, which can be appropriately

Table 1. Specific connections between each data layer and the operation platform in the big data system of Chinese medicine industry.

Layer			Process			
Data integration layer	Industrial big data	Devices (sensor instrumentation)	Control (PAT, DCS)	Workshop (MES, LIMS)	Enterprise (ERP, SCM)	
Data processing layer	Data Modeling	Data preparation (data cleaning, feature identification)	Model construction (process mechanism, artificial intelligence)	Model validation (internal validation, external validation)	Model configuration (scientific decision making, precise execution)	Model maintenance (performance monitoring, model updates)
Application Scenario Layer	Product Lifecycle	Chinese medicine development	Technology Transfer	Commercial production	Distribution	
Operational Platform	Industrial Interconnection	Service Monitoring	Data Security	Computing Engine Standard Interface	Database	Network communication

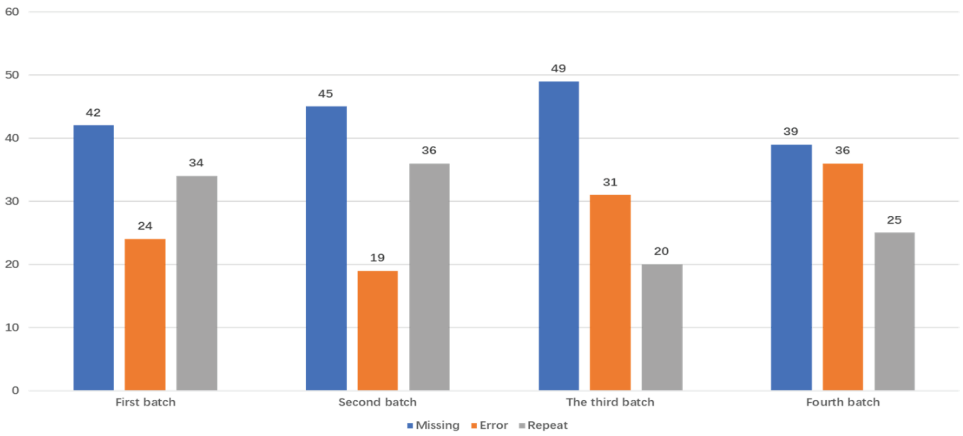

Figure 5. The percentage of various abnormal items in the original data.

rotated and changed in the table, modified in batches into standardized model data, and finally processed for the model. The percentages of various abnormal items in the original data are shown in Figure 5 below.

Strategy Analysis

The core of the big data system for the Chinese medicine industry set up in this paper lies in modeling, emphasizing the cause-and-effect relationships between the various layers and logically connecting the data processing results between the various processes as a way to improve the inductive, perceptual and oriented characteristics of data modeling. Specifically, the data is collected in iTCM's algorithm library, and the best combination is matched according to the set standardized process, while the appropriate algorithm is selected from the model for extrapolation. The difference between the historical data and the existing data in the manufacturing process of TCM is obtained to reduce the error of the TCM process. Such models can also be subdivided into multiple dimensions, such as space, time, and transparency, to select suitable application scenarios for different quality requirements and substitute them, and perform regression analysis under the supervision of predictive modeling to find out the relationship between different variables through the calculation of samples, while making simple judgments on the attributes of variables, distinguishing them by whether they are continuous, reversible, and other conditions, so as to carry out the next step of model This can be used to fine-tune the model and improve the coupling between the model and the data. The statistical radar diagram of the data in the big data system of Chinese medicine industry applied in this paper is shown in Figure 6.

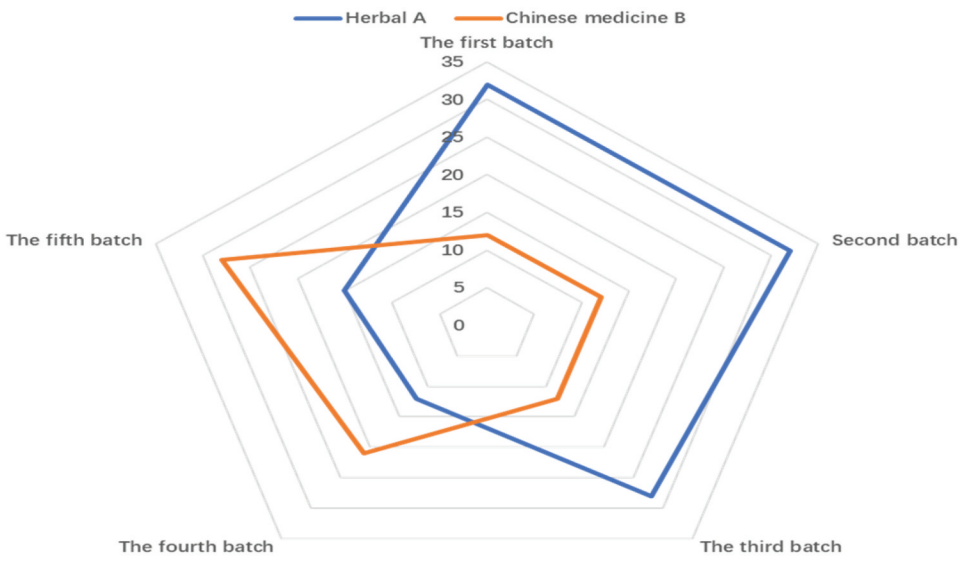

Figure 6. Radar diagram of data statistics in the big data system of Chinese medicine industry.

Results and Discussion

Analysis of Statistical Results

After constructing the model calculation using the Chinese medicine industry big data system, in order to better quantify the results in the form of graphs and other forms for analysis, several samples will be taken below for example analysis.

The first is the analysis of the production process of Chinese medicine Huo Xiang Zheng Qi Shui, the sampling session will use 100 bottles of Huo Xiang Zheng Qi Shui from a manufacturer within 1 year, the processing process of which will be divided, a total of 5 major variables and 3000 data points will be screened, the specific method is RTRT method, the test formula is as follows:

$$DT = 25.84 + 2 \times Dc + 1.45 \times \%H - 4.14 \times \%H \times Dc \quad (2)$$

The results show that the coefficient of determination of the model is 0.8247, the average error is 2.62%, and the number of drug components greater than 90% in the contribution of ingredients is nearly 2800, and the number of abnormalities in the production process of Huo Xiang Zheng Qi Shui is not much under the condition of multivariate statistical process control, a few abnormal batches are related to the content of chlorogenic acid in raw materials, and the remaining very few abnormal items are related to the model The remaining very few abnormal items are related to the parameters set by the model itself, which are within the acceptable range, and the specific production batch results

The specific production batch results are shown in Figure 7.

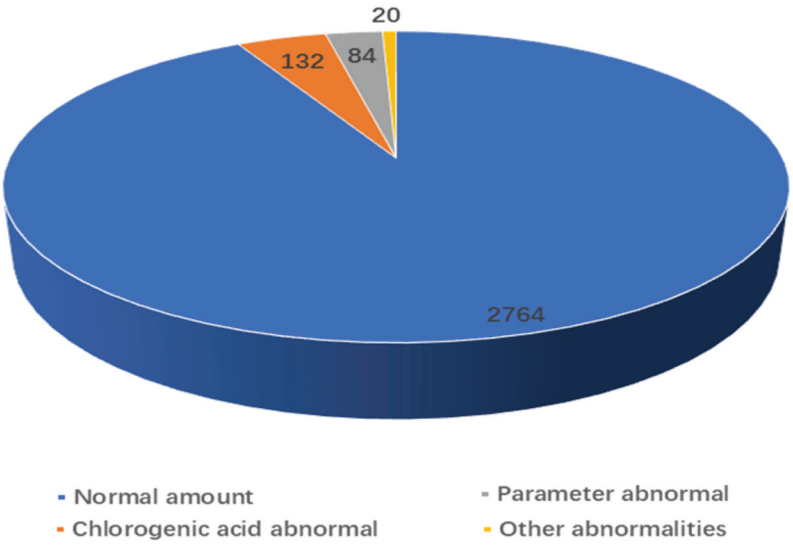

Figure 7. Production process results of Huo Xiang Zheng Qi Shui in the Chinese medicine industry big data system.

Next is the process of production line. Such extrapolation can also be achieved in the Chinese medicine industry big data system. This time, the flow line of Lianhua Qingfei granules is selected, and the existing automated process of a factory is also selected, and the processes involved in controlling raw material extraction, concentration, alcoholic sedimentation, extraction and drying are transferred to the big data system in this paper, and other variables are controlled on the original basis, such as temperature, humidity, pressure, circulation and other parameters remain unchanged. Also take 100 packs of particles a total of 3000 data points, according to the drug liquid density, alcohol precipitation supernatant volume and other criteria to determine the validity of the data, the specific method is the same RTRT method, the test formula is as follows:

$$\mathrm{DT} = 34.09 + 2 \times \mathrm{Dc} + 3.59 \times \%\mathrm{H} - 5.29 \times \%\mathrm{H} \times \mathrm{Dc} \tag{3}$$

The coefficient of determination of the model was calculated to be 0.9017, and the average error was 2.85%. The results showed that nearly 2650 data points met the requirements, and the qualification rate was still maintained at a high level, which had a more obvious lead compared with the general factory's compliance rate. Shown in Figure 8.

From the above two cases, the big data system of traditional Chinese medicine industry has indeed a more obvious improvement for the traditional Chinese medicine industrial production, whether it is the yield rate or the abnormal items, the innovative system will be more advantageous and can better utilize the information characteristics of big data to improve the standardization and automation of production and better meet the growing demand of Chinese medicine products consumption.

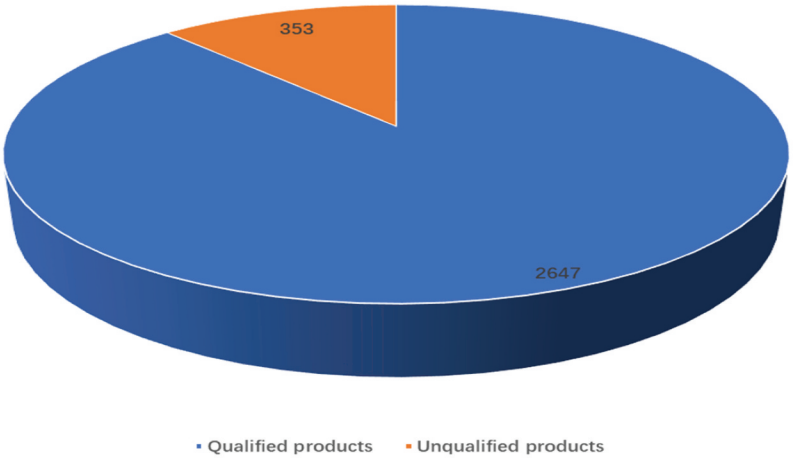

Figure 8. Production compliance rate of Lianhua Qingfei granules in the Chinese medicine industry big data system.

Result Validation

According to the internal and external validation, cross-validation and simple validation proposed above, the root mean square error of the results of the two cases derived from this industrial big data model are 0.82 and 1.72 respectively; the coefficients of determination are 1.72 and 5.63 respectively; the coefficients of cross-validation are 2.41 and 4.91 respectively, all of which meet the requirements of reliable data, so the results calculated by this model can be considered to be Therefore, the results calculated by this model can be considered acceptable.

Analysis of the Mechanism of Model Deduction of Chinese Medicine Production Cases in the Big Data System of Chinese Medicine Industry

This paper analyzes the innovation of the model in the big data system of Chinese medicine industry, and after constructing the corresponding prototype algorithm using the model, it can effectively and completely derive the real-life cases of Chinese medicine production, which is consistent with the previous expectation.

And from the specific model calculation results, the main method adopted is the mass transfer law modeling method, which defines different analysis methods according to different cases, and extracts the amount needed for modeling from the real-life manufacturers' data, and further goes to production according to the parameters and settings, which can be said to select the data table with high value, take its essence, and perform simple simulation operations after substituting into the model. The following problems were

found in the current production process: the agents in the univariate model have different volumes after concentration, the content of the added infusion varies with the volume, and the concentration and volume of the supernatant do not meet the requirements. After the optimization of these problems, the system is more perfect.

In summary, the model in the Chinese medicine industrial big data system is in line with the rational use of industrial big data in an imperfectly competitive market, and will be widely recognized by Chinese medicine manufacturers and consumers on the basis of some innovations.

Discussion

In summary, after constructing the big data system and using the relevant models, and obtaining some data from the Chinese medicine enterprises through actual sampling, this paper, after projection and comparison, summarizes some processes with improved efficiency and increased yield rate, and clarifies the significance of the system and big data for the innovation of the Chinese medicine industry, and here again emphasizes a few specific countermeasures for innovation.

Improve the Security of Big Data of Chinese Medicine

In the era of big data, the most important concern of the big data system of Chinese medicine industry is data security, which is related to the security of Chinese medicine enterprises and the experience of each user. In this regard, the security of big data of Chinese medicine industry can be strengthened from the following aspects.

Data Encryption

Chinese medicine big data itself is very valuable and decisive for technology development and product innovation work, so Chinese medicine enterprises need to set up a strict big data system platform to avoid leakage of Chinese medicine big data through real-time monitoring, firewall and various security applications.

Access Control

The Chinese medicine data management department can be prevented by using autonomous access control, which means that the staff of the Chinese medicine management department has absolute authority to generate access objects and decide the types of users who can use the access rights, and mandatory access control, which means that the system will decide the types of users who can use the access rights according to the pre-defined rules, so as to protect the critical Chinese medicine data.

Statistical Analysis

Self-examination of security issues within the big data system is also an important means to reduce the security risk of the big data system, and statistical analysis can generally be used. The TCM data management department can assess the security problem level based on the conclusion from statistical analysis and take corresponding measures to prevent the security risks that may arise and strictly prevent the internal data security problems.

Optimize the Deployment of Each Platform Layer of TCM

Optimized deployment of the Chinese medicine cloud platform layer is one of the important means of confidentiality at this stage, which is generally divided into two directions: optimized deployment of local computing nodes and optimized deployment of storage platforms.

Optimized Deployment of Local Computing Nodes

The local computing node application deployment mode can integrate the TCM data directly into the set up model and evolve according to the relevant change laws. In the local computing node application deployment mode, the Chinese medicine data management department can realize the early warning of external hackers and arrange personnel to take protective measures in time.

Storage Platform Optimization Deployment

The relevant optimized deployment is also needed between different storage platforms. At this time, each independent storage platform is the key optimization direction of the Chinese medicine cloud platform layer. The real-time sharing and exchange of Chinese medicine data between each other, exploring all the possibilities of changes in Chinese medicine, and providing a comprehensive response plan for Chinese medicine technology development, thus improving the flexibility and efficiency of Chinese medicine secrecy work.

Using Virtualization Technology

Virtualization means that the corresponding computer components run on a virtual basis. According to the three-tier operation mechanism of the Chinese medicine sector in China, virtualization technology can be applied to the field of technological development of Chinese medicine, which can improve the internal working environment, reduce the number of clients for work, improve office efficiency and better communication of each data; it can also improve the flexibility of data confidentiality and shorten the response time through dynamic resource allocation.

Conclusion

In this paper, we have studied and analyzed the innovation of Chinese medicine industry in industrial big data. By constructing the Chinese medicine industrial big data system and substituting the relevant Chinese medicine industry into it, we have obtained the relevant industrial innovation suggestions. Secondly, the innovation of Chinese medicine industry needs to rely on the systematization and automation under big data to a large extent.

Big data of TCM industry is the bridge between the interaction of information system and physical system in the manufacturing process of TCM products. The three-layer architecture of big data in Chinese medicine industry proposed in this study is dedicated to opening the information loop between perception space, cognitive space, and behavior space in the digital world. In the manufacturing process of TCM products, the uncertainty of the process system leads to the dispersion of the output product quality, and the rich information contained in TCM industrial big data can generate new possibilities to solve the process quality control problems. System modeling based on industrial big data is a key means to study the structure and function of TCM manufacturing systems, discover the general laws of process quality transfer, explore how to eliminate or reduce the impact of uncertainty on the dispersion of output performance, and realize the design and control of TCM production process quality reliability from a global perspective, so as to promote further innovation and development of China's TCM industry.In addition to the three-layer architecture proposed in this study, the integration of artificial intelligence algorithms, such as LSTM, can also play an important role in analyzing and processing the big data of the Chinese medicine industry. Through the application of AI algorithms, the TCM industry can further improve the accuracy and efficiency of data analysis, prediction, and decision-making in the manufacturing process, thereby enhancing the reliability and quality of TCM products. The use of AI technology in TCM manufacturing process quality control can help overcome the challenges posed by the uncertainty of the process system, and provide new possibilities for TCM industry innovation and development.

Disclosure statement

No potential conflict of interest was reported by the author.

Data availability statement

Data will be provided upon request

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