International Journal for Housing Science and Its Applications
Publish August 10, 2025. Volume 46, Issue 4 Pages 958-967

https://doi.org/10.70517/ijhsa46489

Research on the Design of Profitability Improvement Strategies in Traditional Chinese Medicine Industry Combined with Digital Twin Technology

Maochong Lei[1,*]
[1] Wuchang Institute of Technology, Wuhan, Hubei, 430065, China
Corresponding authors: (e-mail: leimaochong@126.com).

Abstract The current global digital economy is developing rapidly, and all industries are experiencing profound digitalization changes. As a unique national industry in China, the traditional Chinese medicine industry faces many challenges in the modernization process, such as low production efficiency, difficulty in quality control, and fierce market competition. This study uses factor analysis to construct a profitability evaluation system for the traditional Chinese medicine industry, and analyzes the current situation and development potential of the industry's profitability by establishing a digital twin technology-driven profitability improvement strategy model. The study selected 10 key financial indicators, used KMO and Bartlett's test to determine the applicability of the sample, and extracted three principal factors for analysis. The results showed that the KMO statistic was 0.613, the Bartlett value was 668.651, the cumulative variance contribution rate amounted to 75.903%, and the first common factor variance contribution rate was 35.99%. The analysis found that the profitability factor of traditional Chinese medicine industry experienced significant fluctuations during 2018-2023, decreasing from the highest value of 32.8 to the lowest value of 5.8.The study shows that digital twin technology can effectively improve the profitability of traditional Chinese medicine industry through the three dimensions of Internet of everything, data integration and cloud platform construction, which provides a scientific theoretical guidance and practical path for the digital transformation of the industry.

Keywords: Factor analysis, digital twin technology, traditional Chinese medicine industry, profitability, digital transformation, cloud platform construction

I. Introduction

With the development of China's economy and the aging of the population, there is an increasing demand for the healthcare industry [1]. As an important part of the healthcare industry, TCM has a long history of development, and it is not only China's health and economic resources, but also China's distinctive cultural resources [2], [3]. In the prevention, control and rescue of the Xinguang epidemic, Chinese medicine has also played an equally important role, and research results on the effective treatment of Xinguang pneumonia with Lotus Clearance have been continuously published in international authoritative journals [4], [5]. The culture of Chinese medicine has been further promoted and recognized in the international arena, which has also attracted the attention of many investors to the Chinese medicine industry [6].

Although China's listed companies in the traditional Chinese medicine industry have developed faster in general, and have made considerable achievements in their growth, it is undeniable that the problems of low industrialization level, high degree of product homogenization, and insufficient innovation ability still exist [7]-[10]. At the same time, the Chinese medicine industry is in a special situation, the external factors such as rapid product renewal and harsh conditions of drug storage also seriously constrain the profitability and development of the Chinese medicine industry [11]-[13]. Therefore, a comprehensive understanding of the current situation of profitability of listed companies in this industry, from which to explore the main factors affecting their profitability and seek a solution strategy, can help to solve the difficulties encountered in the development process of the traditional Chinese medicine industry.

Based on the profitability analysis theory and factor analysis model, this study constructs a profitability evaluation framework for the traditional Chinese medicine industry and analyzes in depth the key factors affecting corporate profitability. By selecting representative financial indicators and using multivariate statistical analysis to identify the main profitability drivers, it provides theoretical support for the application of digital twin technology. On this basis, the profitability improvement strategy based on digital twin technology is designed to form a complete digital

transformation solution by combining the characteristics and development needs of the traditional Chinese medicine industry, including key aspects such as data collection and processing, intelligent decision support, risk early warning and control.

II. Relevant theoretical foundations

II. A. Theoretical foundations related to profitability analysis

II. A. 1) Profitability analysis

(1) Definition of Profitability

Profitability is the ability of a company to make a profit. It is also the ability of a company to double its original capital, and it is common to measure profitability by the value of a company's earnings. In general, profitability is categorized into past and future, and is measured using past financial data. The ultimate goal of a company is to "go to the next level" of profitability, which also guarantees operations and internal stability. When analyzing corporate profitability, the combination of absolute and relative values makes the analysis more accurate.

(2) Factors affecting corporate profitability

Factors affecting profitability include the internal and external environment. The external environment will have an impact on profitability, including the country's overall economic situation and the introduction of policies and the purchasing power of consumers will affect profitability. In the case of a complete interpretation of the policy, can be in the price and other aspects of the consumer group to adapt to improve the profitability of the enterprise. The internal environment of the enterprise has peer competition as well as the company's own operational capacity and quality of personnel. At the same time, the company should also be forward-looking and take into account the competitiveness that may be brought about by the same industry that is just starting out. The threat of substitutes cannot be ignored. In the competition, between the same industry, the development of a certain space, the enterprise in order to make a profit, it is necessary to rationalize the use of price, advertising, innovation, etc. to attract customers, expanding profits. Whether a company can adjust its strategy according to the business conditions of its competitors will affect its own profitability. The staff within the enterprise is the strong backing for the development of the enterprise, higher quality staff can make the enterprise work more efficiently, so as to save the cost of personnel and improve the profitability.

II. A. 2) DuPont analysis

(1) Basic Theory of DuPont Analysis

The DuPont method was first utilized by Donald Brown to measure the profitability performance of a business. Under this evaluation system, a comprehensive link can be realized between the operations and financial situation of a company. Since the use of this system, the financial indicators have become more observable and organized. Among them, the net equity margin, as a key indicator, is the center of the system's measurement.

(2) Profitability analysis based on the DuPont model

The structure of DuPont analysis is shown in Figure 1.

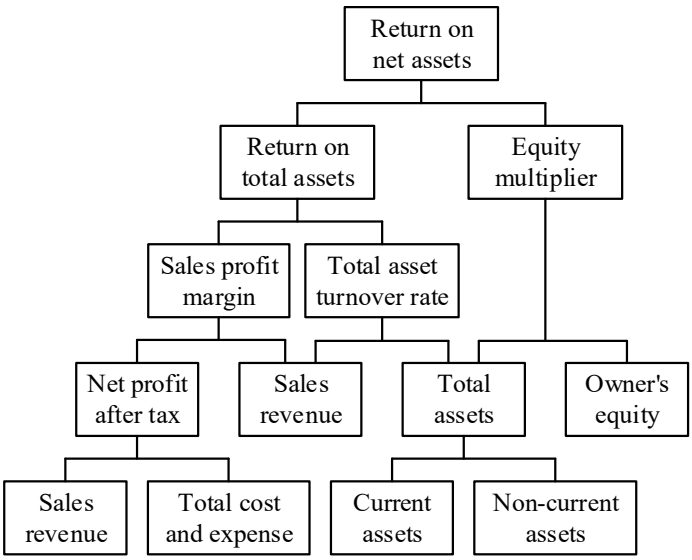

Figure 1: Dupont analysis structure

II. B. Theoretical Foundations Related to Factor Analysis Modeling

II. B. 1) Factor analysis model

(1) Introduction to the model

Factor analysis is similar to cluster analysis in that both types are classified as R-type and Q-type; R-type factor analysis analyzes variables and Q-type factor analysis analyzes samples. In this paper, R-type factor analysis is chosen to analyze the variables [14]. R-type factor analysis is characterized by the fact that the common factors in R-type cannot be observed intuitively, but they are objective common influences. There are n samples, p indicators, $X=(X_1,X_2,...,X_p)^T$ is a random vector, and the common factor to be sought is $F=(F_1,F_2,\ldots F_m)^T$, which gives:

$$X_i=a_{i1}F_1+a_{i2}F_2+\cdots a_{im}F_m+\varepsilon_i,(i=1,2,...p) \tag{1}$$

In the above equation $F_1,F_2,...F_m$ are called the common factors, ε_i are called the special factors of X_i, which represent the variation of the variables due to influences other than the common factors, and X_i are the measurable variables, and the following equation shows the matrix form of the model:

$$X=AF+\varepsilon \tag{2}$$

Among them:

$$\mathrm{A}=\begin{bmatrix} a_{11} & a_{12} & \ldots & a_{1m} \\ a_{21} & a_{22} & \ldots & a_{2m} \\ \ldots & \ldots & \ldots & \ldots \\ a_{p1} & a_{p2} & \ldots & a_{pm} \end{bmatrix}=(A_1,A_2,...A_m) \tag{3}$$

It is called the factor loading matrix, and a_{ij} is the factor loading, whose actual meaning is the correlation coefficient between F_i and X_j.

$$X=\begin{bmatrix} X_1 \\ X_2 \\ \vdots \\ X_p \end{bmatrix},\quad F=\begin{bmatrix} F_1 \\ F_2 \\ \vdots \\ F_p \end{bmatrix},\quad \varepsilon=\begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \vdots \\ \varepsilon_p \end{bmatrix} \tag{4}$$

This mathematical model needs to satisfy the following four aspects:

(a) $m<p$, i.e., the number of extracted common factors is less than the number of original variables.

(b) $Cov(F,\varepsilon)=0$, i.e., the common and special factors are uncorrelated.

(c) $D(F)=I_m$, i.e., the uncorrelated variance of the individual common factors is 1.

(d) $Cov(\varepsilon_i,\varepsilon_j)=0,D(\in_i)=\sigma_j$, i.e., the individual special factors are uncorrelated and have different variances.

(2) Properties of the factor analysis model

(a) Decomposition of the covariance matrix of the original variable X

From $X=AF+\varepsilon$, we get $Cov(X)=ACov(F)A^T+Cov(\varepsilon)$, i.e.:

$$Cov(X)=AA^T+diag(\sigma_1^2,\sigma_2^2,...,\sigma_m^2) \tag{5}$$

$\sigma_1^2,\sigma_2^2,...,\sigma_m^2$ the smaller the value, the more components are shared by the common factor.

(b) The loading matrix is not unique

Let T be a $m\times m$ matrix such that $A^*=AT,F^*=T'F$, then the model can be expressed as $X=A^*F^*+\varepsilon\cdot$

(3) Factor loading matrix

(a) Statistical significance of the factor loadings a_{ij}

For the factor model:

$$X_i=a_{i1}F_1+a_{i2}F_2+\cdots a_{im}F_m+\varepsilon_i,(i=1,2,...p) \tag{6}$$

The covariance between X_i and F_j can be obtained as:

$$\begin{aligned} Cov(X_i,F_j)&=Cov\left(\sum_{k=1}^{m}a_{ik}F_k+\varepsilon,F_j\right) \\ &=Cov\left(\sum_{k=1}^{m}a_{ik}F_k,F_j\right)+Cov(\varepsilon_i,F_j) \\ &=a_{ij} \end{aligned} \tag{7}$$

If X_i is normalized, the standard deviation of X_i is 1 and the standard deviation of F_j is 1, there is:

$$\gamma_{X_{i,F_j}} = \frac{cov(X_i, F_j)}{\sqrt{D(X_i)}\sqrt{D(F_j)}} = Cov(X_i, F_j) = a_{ij} \tag{8}$$

Then, for the standardized X_i, a_{ij} is the correlation coefficient between X_i and F_j, indicating the weight, or power, of the dependence of X_i on F_j. Psychologists call it the loading, which indicates the loading of the i th variable on the j th common factor, reflecting the relative importance of the i th variable on the j th common factor.

(b) Statistical significance of variable commonality

There are factor models known:

$$\begin{aligned} D(X_i) &= a_{i1}^2 D(F_1) + a_{i2}^2 D(F_2) + \cdots + a_{im}^2 D(F_m) + D(\varepsilon_i) \\ &= a_{i1}^2 + a_{i2}^2 + \cdots + a_{im}^2 + D(\varepsilon_i) \\ &= h_i^2 + \sigma_i^2 \end{aligned} \tag{9}$$

The common degree of variable X_i is:

$$h_i^2 = \sum_{j=1}^{m} a_{ij}^2 \quad i = 1, 2, ..., p \tag{10}$$

If X_i is normalized, there:

$$1 = h_i^2 + \sigma_i^2 \tag{11}$$

(c) Statistical significance of the variance contribution g_j^2 of the common factor F_i

Let the factor loading matrix be A. Call the sum of squares of the j th column element, i.e:

$$g_j^2 = \sum_{i=1}^{p} a_{ij}^2 \quad j = 1, 2, ..., m \tag{12}$$

is the contribution of the common factor X_i to F_j, i.e., g_j^2, which indicates the extent to which the information of the variable X_i can be described by the extracted k common factors, with the value interval of (0, 1), and the higher the value of g_j^2, the higher the variable can be explained by the common factor The higher the information ratio is. The relative importance of the common factor F_j can be measured by g_i^2 / h, which is called the contribution of the common factor F_j to X. The purpose of factor analysis is to find the solution of the factor analysis model from the covariance array Σ or correlation array R of the original random vectors, i.e., to find the loading array A and the characteristic covariance array D_ε, and to make the relevant explanatory remarks.

II. B. 2) Steps in factor analysis

First, the original data with high reliability and authenticity are selected, and such data are usually obtained based on the research of actual problems.

Second, standardize all the original variables to eliminate the influence of variables in the order of magnitude, and then obtain the correlation matrix based on the standardized data and convert it into the correlation between variables.

Third, principal component analysis is utilized to solve the common factor and derive the factor loading matrix.

Fourth, in order to make the coefficients in the factor loading matrix more significant, the factor loading matrix can be rotated, and in this paper, the maximum variance orthogonal rotation method is utilized to maximize the relative sum of squares of the loadings and to name the factors for interpretation.

Fifth, the component matrix scores of the factors are calculated.

Sixth, the results are analyzed and conclusions are drawn.

The logic diagram of factor analysis is shown in Figure 2.

III. Results and analysis

III. A. Evaluation of profitability based on factor analysis method

III. A. 1) Profitability analysis and evaluation system

There are many methods to measure profitability, and choosing a single indicator cannot fully reflect the characteristics of the evaluation object, and choosing many indicators requires assigning weights to different indicators, which will bring difficulties in statistical analysis. Factor analysis method can overcome the above difficulties, its basic principle is to group variables according to the size of the correlation, the higher correlation variables in the same group, then the higher correlation between the variables in the group, which can reduce the number of variables, reflecting the idea of dimensionality reduction. This paper examines the profitability of the chemical pharmaceutical industry from the profitability of the traditional Chinese medicine industry, the stability of

profitability, profitability of cash to examine the profitability of the chemical pharmaceutical industry, profitability evaluation indexes as shown in Table 1.

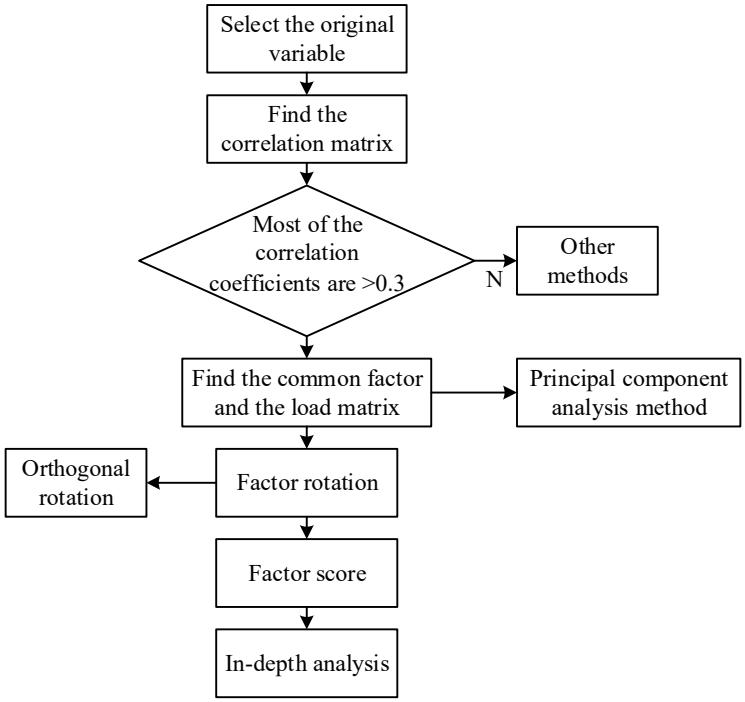

Figure 2: Factor Analysis logic diagram

Table 1: Profitability evaluation index

Financial index	Symbol	Computational formula
Profit margin	X1	Operating profit/sales revenue
Net profit	X2	Net profit/sales revenue
Return on equity	X3	Net profit/net worth
Main business profit margin	X4	Operating profit/main business income
Non-recurring profit and loss ratio	X5	Non-recurring profit/profit total
The main business is sharp	X6	(operating profit - other business profit)/total profit
Profit growth	X7	(Current profit - last year's net profit)/ last year's net profit
Cash guarantee factor for profitable revenue	X8	Operating activity cash flow/net profit
Main business revenue ratio	X9	The seller and the service receive cash/main business income
Operating profit revenue rate	X10	Net cash flow/operating profit

III. A. 2) Profitability Assessment of Traditional Chinese Medicine Industry

(1) Data standardization

In this paper, the raw data are firstly organized and calculated, and the 10 data indicators required for this factor analysis are derived. Secondly, the original data are processed in the same direction, and among the 10 selected indicators, the current ratio and quick ratio are moderate indicators.

(2) Determine whether it is suitable for factor analysis

Then this paper uses KMO and Bartlett test to detect whether the selected samples are suitable for factor analysis. KMO is greater than 0.5 can do factor analysis. Bartlett sphericity test results if the significance level is less than 0.05, then it is appropriate to do factor analysis. KMO and Bartlett test is shown in Table 2. As can be seen from the table, KMO statistic takes the value of 0.613 which is greater than 0.5 and Bartlett's value is 668.651 with a significance level of 0.000 (p less than 0.05) which is eligible.

Table 2: KMO and Bartlett tests

The sample is sufficient for the sampling of Kaiser-Meyer-Olkin	Measure	0.613
Bartlett's spherical test approximation card	668.651	
	df	46
	Sig.	0.000

(3) Determination of principal factors

Extraction method: principal component analysis. The calculations were all done by SPSS software, and the total variance explained by the eigenvalues is shown in Table 3. According to the results, it can be seen that there are 3 eigenvalues that satisfy the conditions, and the cumulative contribution rate of variance is 75.903%, which indicates that these 3 public factors extracted from 10 original variables can explain the profitability situation of the industry better. Among them, the initial eigenvalue of the 1st public factor is 4.156, and the variance accounts for 41.556 of all the variance, indicating the strongest ability to synthesize the original variables. The variance of the 2nd and 3rd public factors accounted for 22.388% and 11.959% of the total variance, respectively, and their weights became smaller in turn, and their ability to synthesize the original variables gradually decreased. Since they have reflected most of the information of the original variables, these 3 public factors can be selected to represent the 10 original variables for the purpose of dimensionality reduction.

Table 3: The total variance of the eigenvalues

Constituent	Initial eigenvalue			Extract the sum of squares			Load the rotational squares and load		
	Total	Variance (%)	Accumulated (%)	Total	Variance (%)	Accumulated (%)	Total	Variance (%)	Accumulated (%)
1	4.156	41.556	41.556	4.156	41.56	41.56	3.599	35.99	35.99
2	2.239	22.388	63.944	2.239	22.39	63.95	2.651	26.51	62.5
3	1.196	11.959	75.903	1.196	11.96	75.91	1.341	13.41	75.91
4	0.951	9.509	85.412						
5	0.87	8.699	94.111						
6	0.423	4.23	98.341						
7	0.108	1.08	99.421						
8	0.033	0.33	99.751						
9	0.023	0.23	99.981						
10	0.002	0.02	100						

(4) Determine the rotated factor loading matrix

The rotated factor loading matrix is shown in Table 4. As can be seen from the table, the main factor has a large loading on the main operating profit margin, net sales margin, return on net assets, and profitability of main business, which indicates that F1 mainly contains the information of the above indexes, and therefore F1 is named as the profitability factor. The variance contribution ratio of main factor F1 is 35.99%. The main factor F2 has a larger loading on the ratio of non-recurring gains and losses, and the operating cash security coefficient, so F2 is interpreted as the corporate stability factor. Operating cash security coefficient, main business cash collection ratio and operating business cash collection ratio have large loadings on the third male factor, and the main factor F3 can be categorized as profitability collectability.

Table 4: The factor load matrix after rotation

	Constituent		
	1	2	3
X1	0.958	-0.152	-0.009
X2	0.956	-0.116	-0.072
X3	0.798	-0.117	0.081
X4	0.955	-0.16	-0.046
X5	-0.14	0.969	-0.131
X6	0.242	-0.924	0.109
X7	0.064	-0.004	-0.569

X8	-0.09	0.953	0.186
X9	0.329	0.16	0.615
X10	-0.119	-0.16	0.704

(5) Calculation of factor scores

The matrix of component score coefficients is shown in Table 5. The score of each factor was calculated according to the formula, and then the composite score was calculated with weights in terms of the variance contribution of each factor, i.e., F=(35.99%F1+26.51%F2+13.41%F3)/777.652%.

Table 5: Component score coefficient matrix

	Constituent		
	F1	F2	F3
-667527836X1	0.27	0.04	-0.01
X2	0.286	0.043	-0.059
X3	0.228	0.017	0.059
X4	0.264	0.033	-0.05
X5	0.047	0.358	-0.08
X6	-0.007	-0.335	0.07
X7	0.014	0	-0.466
X8	0.064	0.353	0.168
X9	0.108	0.101	0.482
X10	-0.06	-0.065	0.544

III. B. Profitability Assessment of Traditional Chinese Medicine Industry

The profit level of traditional Chinese medicine industry has been stable in the past seven years, and the correlation between profitability and development capacity is weak. The yearly chart of the main analyzed indicators of the traditional Chinese medicine industry is shown in Figure 3. The yearly chart of the main analyzed indicators of traditional Chinese medicine industry is shown in Figure 4. On the one hand, the profit margin and fee control level of traditional Chinese medicine industry is stable, and the profit operation factor of China's traditional Chinese medicine industry has little ups and downs in 2018-2024, and the main business starkness rate and profit growth rate are running smoothly, and the pivot of growth is maintained at 7.5% and 8.5%, respectively, with small fluctuations. On the other hand, the profitability factor of China's traditional Chinese medicine industry experienced a significant decline in 2018-2014, from the highest value of 32.8 in 2018 to the lowest value of 5.8 in 2023, with the highest amplitude of 24.2% during the period. In addition, the increase in profitability cashability factor in 2024 compared with 2023 increased by 5%, and further verification of the 2018 data is needed to determine whether it has bottomed out from the trend.In 2018, the profitability cashability factor of the traditional Chinese medicine industry has a high weighting on the contribution to the profitability of the traditional Chinese medicine industry, and several indicators covered by the profitability cashability factor are at the 2018- 2024 historical highs, so the evaluation of profitability in 2018 is mainly contributed by the profitability cashability factor.

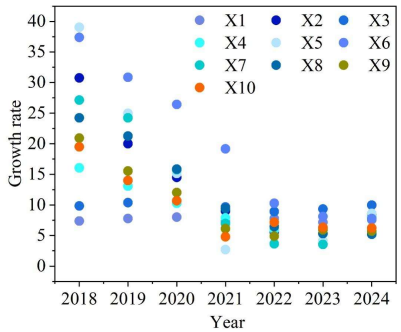

Figure 3: The main analysis of the traditional Chinese medicine industry is the year

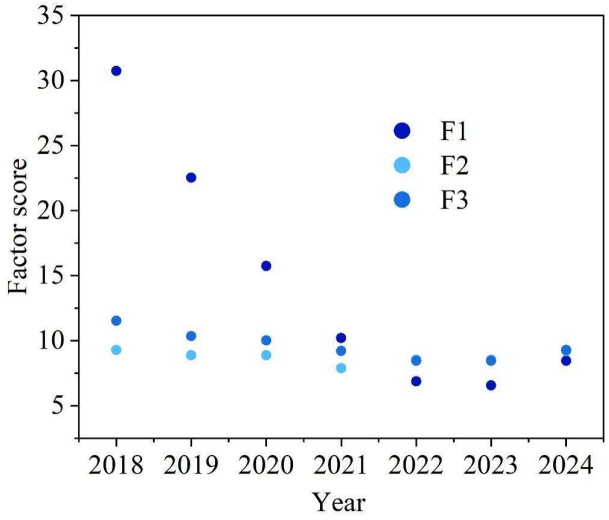

Figure 4: The main analysis of the traditional Chinese medicine industry is the year

IV. Digital transformation measures for the traditional Chinese medicine industry

IV. A. Interconnection of everything for real-time access to data

Data collection facilities are the basis of governance and operational data, through the Internet of Things technology, real-time access to the production and planting of front-line data, production personnel can conveniently grasp the information through mobile devices, providing data support for standardized management. Cultivation link, the traditional Chinese medicine industry in the digital base to introduce quality traceability system, planting staff will be daily agricultural operation records photographed and uploaded to the system, at the same time the field are installed and equipped with sensors, through the small program can be remotely understand the soil condition and environmental conditions, at the same time, this information is also connected to the digital industrial platform, become an important means of upgrading traditional agricultural products to standardized industrial products. Production, the traditional Chinese medicine industry benchmarking industry 4.0, built a smart factory, based on the deep integration of information technology and digitalization, the construction of four major information technology systems, digital records of the entire production process and real-time information push, to achieve all the production management can be centralized in the central information processing department to complete. Through the planting and production of various types of information collection equipment, the data foundation for the construction of the traditional Chinese medicine industry database has been laid.

IV. B. Build a database platform for data integration

Since the digital transformation strategy was proposed, the traditional Chinese medicine industry has been committed to integrating the data of the Group's functional departments and business departments to build an all-process and all-around database platform. The company has initiated the construction of master data system, “data lake” construction, membership system construction, and master data system construction around White Medicine Life+ business. Specifically, it includes the planning of six data domains: users, customers, suppliers, employees, organizations and commodities. The “data lake” is centered around the C-end reachable user information into the lake and supports the White Medicine Life+ business decision analysis to carry out pilot applications. The membership system carries rich and diverse C-end operation scenarios and enhances customer stickiness. Through the creation of the group data system, it runs through the operation of various departments of the group and creates a big data moat.

IV. C. Introducing Mobile Cloud for Digital Intelligence Upgrade

Database provides a platform for enterprise data integration, but after all, there are a large number of data that have no economic utilization value or cannot be identified to determine whether there is economic profitability in the future under the existing technology and knowledge conditions, therefore, it is also necessary to use data governance and operation platform to make data become exchangeable and interpretable data resources.

In the early stage of digital transformation, the traditional Chinese medicine industry mainly relies on its own IT infrastructure and private cloud for data governance and operation. With the advancement and deepening of digital transformation, the original facilities are unable to meet the needs of digital transformation, and the cost of private

cloud operation and maintenance is also rising rapidly. In the late stage, the traditional Chinese medicine industry introduces mobile cloud, relying on powerful computing power, network infrastructure resources and secure and controllable cloud service solutions. With the help of mobile cloud, the traditional Chinese medicine industry has built a full-stack exclusive cloud platform, providing an integrated solution with highly integrated services, integrated opening of resources, unified operation and maintenance monitoring, and realizing efficient utilization, on-demand allocation, elastic expansion and automated management of system IT resources. At the same time, through localized deployment, it realizes data without leaving the province and meets the requirement of data isolation for core business in the cloud.

As the “cloud base” for the digital upgrading of the traditional Chinese medicine industry, the Mobile Cloud Full Stack Exclusive Platform carries the operation and production systems of the four main businesses of the traditional Chinese medicine industry, namely the Pharmaceuticals Division, the Health Products Division, the Traditional Chinese Medicine Resource Division, and Yunnan Pharmaceuticals Company Limited, and meets the basic cloud requirements for computation, storage, network, security, and so on. Through the cloud platform, each division can apply for computing and storage of data resources through the work order platform, and the platform operation and maintenance department can complete the response and deployment usually within one hour through resource deployment, which effectively improves the processing efficiency of data.

V. Conclusion

This study draws the following conclusions through the in-depth analysis of the profitability of the traditional Chinese medicine industry and the systematic design of the application strategy of digital twin technology. The results of the factor analysis show that the three extracted public factors can effectively explain the information of the original variables, among which the profitability factor, stability factor and earnings collectability factor reflect different dimensions of corporate profitability, respectively. The data shows that the increase in profitability cashability factor increased by 5% in 2024 compared to 2023, indicating that the industry has improved in cash flow management. Profit margin from main business and profit growth rate are running relatively stable, with the pivot of increase maintained at 7.5% and 8.5% respectively, showing the stability of the industry's overall development. The application of digital twin technology has brought significant transformation opportunities for the traditional Chinese medicine industry, realizing real-time monitoring and data collection of the whole production process through the Internet of Everything, providing a data foundation for accurate decision-making. The construction of the database platform integrates business data from various departments of the enterprise, forming a complete system covering six data domains, including users, customers and suppliers. The introduction of the mobile cloud platform further improves data processing efficiency, shortens the response time for resource deployment to within one hour, and effectively reduces operation and maintenance costs. The implementation of these technical measures not only improves production efficiency and product quality, but also enhances the enterprise's market competitiveness and sustainable development. The successful application of digital twin technology in the traditional Chinese medicine industry provides a useful reference for the digital transformation of other traditional industries, proving the important role of technological innovation in promoting industrial upgrading.

References

[1] Kessler, C. S., Perera, P. K., Puthiyedath, R., & Dhruva, A. (2025). The increasing relevance of traditional medicine systems for the primary health care sector and general practice: global research perspectives. Frontiers in Medicine, 11, 1533361.

[2] Wang, W. Y., Zhou, H., Wang, Y. F., Sang, B. S., & Liu, L. (2021). Current policies and measures on the development of traditional Chinese medicine in China. Pharmacological research, 163, 105187.

[3] Khan, M. S. A., & Ahmad, I. (2019). Herbal medicine: current trends and future prospects. In New look to phytomedicine (pp. 3-13). Academic Press.

[4] Xiao, M., Tian, J., Zhou, Y., Xu, X., Min, X., Lv, Y., ... & Tong, X. (2020). Efficacy of Huoxiang Zhengqi dropping pills and Lianhua Qingwen granules in treatment of COVID-19: a randomized controlled trial. Pharmacological research, 161, 105126.

[5] Fan, S. J., Liao, J. K., Wei, L., Wang, B. Y., Kai, L., & Tan, D. X. (2022). Treatment efficacy of Lianhua Qingwen capsules for eraly-stage COVID-19. American journal of translational research, 14(2), 1332.

[6] Sospiro, P. (2018). Investments, Research, Education, and TCM. In Healthcare Policies and Systems in Europe and China: Comparisons and Synergies (pp. 153-194). World Scientific.

[7] Wang, Y., & Zhang, J. (2019, December). Study on the Competitiveness of Traditional Chinese Medicine Enterprises Based on the Factor Analysis. In 2019 3rd International Conference on Education, Economics and Management Research (ICEEMR 2019) (pp. 140-143). Atlantis Press.

[8] Han, Y., Xiang, W., Dou, M., Wang, J., & Liu, J. (2023). Analysis of economic environment and financial capability of traditional Chinese medicine industry—take a long-established Chinese medicine company as an example. Academic Journal of Business & Management, 5(3), 127-133.

[9] Ren, W., Fu, X., Tarimo, C. S., Kasanga, M., Wang, Y., & Wu, J. (2021). The scale and structure of government financial investment in traditional medicine based on optimal efficiency: evidence from public traditional Chinese medicine hospitals (PTHs) of Henan province, China. BMC health services research, 21, 1-10.

[10] Zhang, X. (2024). Development Research and Industry Trend Analysis of Contemporary Innovative Culture Industry of Traditional Chinese Medicine from the Perspective of Economics. Open Journal of Social Sciences, 12(1), 501-514.
[11] Wang, J., Wong, Y. K., & Liao, F. (2018). What has traditional Chinese medicine delivered for modern medicine?. Expert Reviews in Molecular Medicine, 20, e4.
[12] Chao, J., Dai, Y., Verpoorte, R., Lam, W., Cheng, Y. C., Pao, L. H., ... & Chen, S. (2017). Major achievements of evidence-based traditional Chinese medicine in treating major diseases. Biochemical pharmacology, 139, 94-104.
[13] Yang, Z. Q., Tang, Y. Q., DU, Y. P., Tang, H. M., Zhang, L., Gao, R., ... & Yuan, W. A. (2021). Development of clinical trial of new drugs of traditional Chinese medicines. China Journal of Chinese Materia Medica, 1691-1695.
[14] Filatov Evgeniy. (2022). Analysis of profitability of production of enterprises in the field of transportation and storage of the Irkutsk region. Transportation Research Procedia,63,518-524.