A Prediction System of Economic Parameters in the Textile Industry using Artificial Neural Networks

Hong Jiang*, Hong Zhao

College of Economics, Tianjin Polytechnic University, Tianjin, China

***Abstract* — In this paper, we deal with the application of prediction systems of typical economic parameters in the textile industry using artificial neural networks. The prediction system is used to solve the problem of development prediction in that industry while the neural network algorithm is used to improve the accuracy and efficiency of the prediction system. The experimental results show that the prediction system of typical economic parameter based on neural network can improve the performance of textile industry development prediction and has played a certain role in promoting the development of the industry.**

Keywords - prediction system; typical economic parameter; neural network; textile industry

I. INTRODUCTION

The textile industry is the leading industry of the industrialization process in the developed countries; it is also a pillar industry in the developing countries. China is the largest producer, exporter, and consumer country in the world for textile products. The textile industry is a huge contributor to the steady development of the national economy; it also has a long-term influence on the world. To date, the textile industry in China is in a critical period of structural adjustment. A comprehensive comparison of China's international competitiveness in the textile industry becomes one of the best ways to explore the development of China's textile industry, especially using the typical index.

Textile industry is one of the countries and regions of the early stage of industrialization leading industries, textiles and clothing and then become the most main foreign trade export of manufactured goods. The textile industry in the industrial countries occupies an important position in. China's modern textile industry started relatively late, but modern rapid development. At present, the textile industry in China is the traditional pillar industry. In the current economic globalization background, the traditional industrial countries have made structure adjustment, the textile industry is also from labour-intensive industry to capital and technology intensive industry transformation, the developed country's capital technology comparative advantage and developing countries comparative advantage of labour force is complement each other, and constantly changing international textile market trade pattern.

China has become the world's largest producer and exporter of textiles, textile industry in China has been a pillar industry in national economy. China's textile industry from the past labour-intensive is slowly to the high technology transformation. The development of the textile industry encountered unprecedented opportunities, but also faced with unprecedented challenges. In the new form of textile industry is deeply research on the development of the textile industry play a vital role. Based on the impact of China's textile and each factor analysis, the paper reveals impact China's textile and the international influence of the various elements of the individual factors present situation and competitive status, taking prediction system of typical economic parameter based on neural network as the foundation, study the to our country textile industry international competitiveness influence, and further research diamond model of the relationship between the various elements. Because of our country's textile industry based on Labour costs on the basis of comparative advantage, so this paper takes labour cost advantage as the foundation, in-depth analysis of the other factors and the relationship between the labour cost and other factors of the international competitiveness.

Through the analysis, this paper argues that in the current follow factor endowment of comparative advantage of the textile industry development for our country still has very realistic significance, we should vigorously promote the comparative advantage to competitive advantage change, in addition, due to the southeast Asia and other emerging markets, the emergence of China should face to face with challenge, make full use of our comparative advantages, cultivate textile products of industry cluster, for the development of the textile industry to provide a good environment.

In accordance with the aim which builds our big textile country into a stronger country be put forward by our country in fifteen long-term programs, the Hasanbeigi's [1] paper analyses the advantages and the weakness about our textile industry. It regard theory, regional economy, ecological economy and industry's economic theory of sustainable development as guide, adopt decision tree and key factor law to reflect each appraisal factor concrete index of state analyses, have chosen the comprehensive evaluation factor system, structure the three-levels comprehensive evaluation system of sustainable development of textile industry which consist of 4 kinds, 48 indexes On the basis, the weight and the standards of evaluation determine by

using Delphi' method . It handle both data quantity and qualitative by using, the fuzzy mathematics. Finally, comprehensive evaluation coin can be obtained for textile enterprises' ability of sustainable development which provide a reference synthetically for the textile enterprises and the relevant [2].

II. Economic cycle theory and current state of textile industry in China

The study of the economic cycle since the industrial revolution, especially from the first crisis in 1825, is very much the concern of theorists at home and abroad. The research in capitalist economic crisis and recession had promoted the development of the theory. In late 2007, the global financial tsunami which triggered by the U.S. subprime mortgage crisis impacted national economies, that set off the concern of the economic cycle theory. In this new trend, the theory of innovation and development that the Austrian economist J. A. Schumpeter advocated stood out in a number of theories, and had been widely recognized [3]. However, there is very little theoretical research in further application of innovation theory to specific areas of the industry. Also in this financial tsunami, the textile industry has been a huge impact. China's textile exports sharp drop, and many businesses failures.

The industry took a downturn. But scholars discuss the development of the textile industry and research focused on policy measures, such as industrial restructuring, upgrading industrial transfer. Wang's [4] article attempts to apply the economic cycle theory to specific areas of the textile industry, explore the innovation and development of textile industry links with the economic cycle, and the characteristics and regularity in the development process. Using historical analysis and econometric methods, it firstly discusses the relevance and the same trend between the world economic cycle and the development of world textile industry, secondly analysis the characteristics of every ten years' economic cycle from China's reform and opening up, and the technology and system innovation of the textile industry in each expansion phase. Then find the proposals for China's textile industry to begin a new round of development.

Ganesan's [5] paper summarizes innovation theory and other related theories about economic cycle and. It is very reasonable, and logical to discuss the innovative development of industry base on the innovation theory which is explained the economic cycle. Wagan's [6] paper with the historical analysis, summarize the development process of the world textile industry along with the economic cycle and the technological progress at every stage which have promoted the development., thus theoretically revealed the regularity of textile industry development, and the link between the economic cycle.

When research in the development of China's textile industry periodic contact with the world economy, Adhau [7] uses textile exports and world GDP two indicators to make correlation analysis, regression analysis, BP filter trend and cycle analysis, and from the perspective of the data further confirmed the fluctuation in the cycle on both the similarity and relevance. Gambhir's [8] paper summarizes the symbol of technological and institutional innovation in each cycle that promoted the development of China's textile industry, and shows the direction and the next round of development proposals. The theoretical value and innovation is the theory of macroeconomic cycles applied to the textile industry, summed up its development cycle regularity and characteristics. That innovation is the engine of a new round growth for textile industry.

The textile industry is a traditional advantage industry of our country, which made important contribution for national economic development. Textile industry of our country also has stronger international competitiveness and depends on international market to higher degree. Fabrics and clothing trade are one of the disputable trade fields between developing country and developed country. "ATC" replace "MFA", which indicate fabrics and clothing trade moving towards track of liberalization. Our country is a leading power in textile industry, which not only is a traditional industry but a principal one in national economy. China since 1994 has become the country producing and exporting the biggest amount of textile and garment, whose export accounts for 1/7 of that of the world total, and 1/4 of export of our country. Comparative advantage of our textile industry is becoming less and less with textile technique advancing and dramatic competition of other countries. Therefore, competitive advantage appears more important.

Nakano's [9] paper not only defines advantage and explains absolute advantage, comparative advantage , competitive advantage and the development of the advantage theory but also summarizes the current situation of textile industry both at home and the world as well. It laid foundation upon the analysis of competitive advantage of textile industry. Kabdaşli [10] analyses the competitive advantage of China's textile industry form three aspects: firstly, the author thinks the synthetic competitive ability of textile industry is weaker. This fact has an effect on the international competitive ability by means of using factor analysis between textile industry and the others; secondly, the author puts realized index and AHP into use on the basis of M. E. Porter theory and China's specific condition, and comes to a conclusion that the trend of China's textile international competitive advantage is coming down; thirdly, the author thinks the industrial environment cannot be ignored, though the industry itself is equally important. In view of the above, the paper adopts the industrial cluster analysis, which can demonstrate that our textile industry has not yet won the capability of maintaining the long-term competitive advantage. So our country cannot enjoy right of trade liberalization completely from January 1, 2005 according to "ATC". Besides, the fabrics of our country will face the fiercer international market of the competition. Under fabrics liberalization of trade, I carry on theory analysis and analyse fabrics international competitiveness of our country with the real example, then put forward the countermeasure of improving the international competitiveness of our country's fabrics.

III. BP NEURAL NETWORK ALGORITHM IN PREDICTION MODEL

Specifically speaking, BP neural network is a technology based on reverse error. Now, it has become a mature neural network technology. Its neural network designs the algorithm based on gradient descent and adjusts the weights and thresholds of network to make the total error between the expected value of output and the actual value of output become the minimum. The structure figure of the BP neural network is shown in Fig. (**1**):

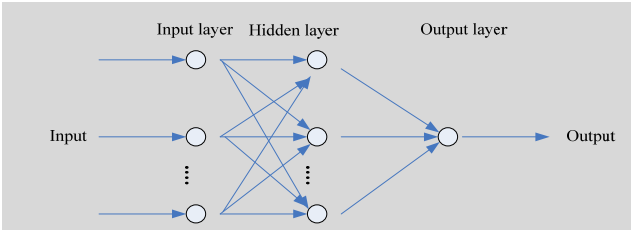

Figure. 1 The structure figure of BP neural network

In order to make up for these shortcomings of BP neural network, this study uses the PSO algorithm in BP neural network to improve it. The steps are as follows:

(1). First, initialize the target vector and transfer function of BP neural network.

(2). According to the actual needs, set the upper limit of iterations of the particle swarm and the largest scale, as well as set the initial velocity and position of particles randomly.

(3). Using the training set to train the BP neural network and evaluate the adaptation situation of particles.

(4). Make a comparison between the original global optimal value and the current value of particles and take the optimal value of both.

(5). Calculate the inertia weight of BP neural network.

(6). To update the velocity and position of the particle timely, and save the difference of the adaptive value between individual particles and particle swarm.

(7). According to the error limit and the upper limit of iterations, if the error of the system adaptive value exceeds one of them, the training is over; at this time, the original global optimal value of particles is the optimal weights and thresholds which are needed by the BP neural network.

Variable $x^{(0)}$ has the original data series $x^{(0)}=\left[x^{(0)}(1),x^{(0)}(2),...,x^{(0)}(n)\right]$, with a 1-AGO order to generate an accumulated generating sequence $x^{(1)}=\left[x^{(1)}(1),x^{(1)}(2),...,x^{(1)}(n)\right]$. Among them:

$$X^{(1)}(k)=\sum_{i=1}^{k}x^{(0)}(i) \tag{1}$$

Since the sequence $X^{(1)}(k)$ has an exponential growth law and the solution is just a first-order differential equations exponential growth in the form of solution. So it can be considered the sequence $X^{(1)}$ satisfies the following first-order linear differential equation model. It can be expressed as the following equation (2) which shows as:

$$\frac{dx^{(1)}}{dt}+\alpha x^{(1)}=\mu \tag{2}$$

In the formula, α and μ are parameters. μ is the control. Solution of the differential equation as follows:

$$x^{(1)}(k+1)=\left[x^{(0)}(1)-\frac{\overline{\mu}}{\overline{\alpha}}\right]e^{-\overline{\alpha}k}+\frac{\overline{\mu}}{\overline{\alpha}} \tag{3}$$

Among them, $\overline{\alpha}$ and μ are the approximate solution of formula (2), according to the least squares method to obtain:

$$\begin{bmatrix}\overline{\alpha}\\ \overline{\mu}\end{bmatrix}=(B^TB)^{-1}B^TY \tag{4}$$

$$Y_n=\begin{bmatrix}x^{(0)}(2)\\ x^{(0)}(3)\\ ...\\ x^{(0)}(4)\end{bmatrix}_{n-1} \tag{5}$$

formula(5) called GM (1,1) model of response time function model, it is a specific formula for calculating GM (1,1) model of gray prediction, this type do regressive reduction, gray had predicted the number of columns in the original model:

$$\overline{x}^{(0)}(k+1)=\overline{x}^{(1)}(k+1)-\overline{x}^{(1)}(k) \tag{6}$$

However, in practice, sometimes people not only care about the fitting effect of neural networks, but also very concerned about the value of the input, which can lead the output to achieve maximum or minimum. This problem is actually based on the optimization problem of BP neural network, by now, the research on this issue has not yet be reported. Although some literatures are referred to as BP neural network optimization, but they are focus on the weights, learning rate and network structure optimization of BP neural network, according to the relationship between BP neural network input and output, and to choose a better output value, which is actually not really optimization, but a simulation, it is to choose an optimal solution from simulation results. Therefore, it has not only of theoretical significance, but also important application value in exploration of real BP neural network optimization method.

Here the use of the BP neural network model with multi-input and single-output as building performance evaluation, the topology is shown in Figure 2.

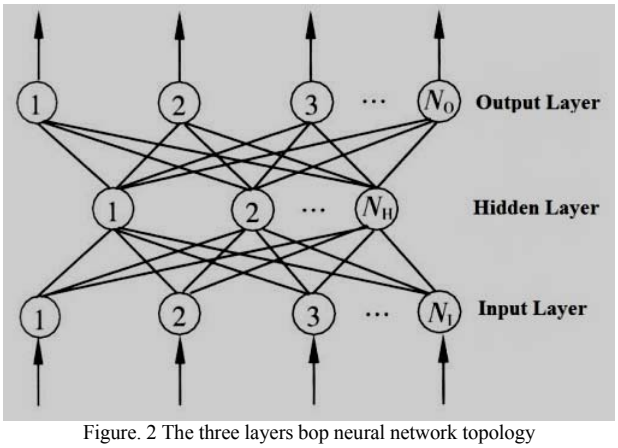

Figure. 2 The three layers bop neural network topology

Sigmoid function, that is:

$$f(x) = \frac{1}{1+e^{-x}} \tag{7}$$

BP network learning and training is a back propagation and correction process. The total error is defined samples of actual output and the desired output function is:

$$E_{total} = \frac{1}{2}\sum_{i=1}^{n}(b_i - b_i')^2 \tag{8}$$

Each index can score from reviewer's subjective scoring method after obtaining. The data to be using equation (9) is normalized.

$$\overline{x_i} = \frac{x_i - b_i}{a_i - b_i} \tag{9}$$

Where X_i and X_j respectively, the i-th index and the actual value Standard value; a_i, b_i are the maximum, minimum, the i-th index. Known evaluation indexes m, n hidden layer nodes depending Problems and experimental data to determine, you can also experience the value of the formula (4) the decision.

$$n = \log_2 m \tag{10}$$

Hidden node output is calculated as follows:

$$h_j = f\left(\sum_{i=1}^{m} w_{ij}x_i - \theta_j\right) \tag{11}$$

where θ_j is defined as the threshold value for hidden node. The output of the output node is calculated as follows:

$$f\left(\sum_{i=1}^{m} w_{ij}x_i - \theta_j\right) = f\left(f\left(\theta_j\right)\right) \tag{12}$$

Where θ is an output node threshold.

IV. Experiment and Data Analysis

At present, the textile industry in China is the traditional pillar industry. In the current economic globalization background, the traditional industrial countries have made structure adjustment, the textile industry is also from labour-intensive industry to capital and technology intensive industry transformation, the developed country's capital technology comparative advantage and developing countries comparative advantage of labour force is complement each other, and constantly changing international textile market trade pattern. In this paper, we select 20 typical economic indicators to study prediction system of typical economic parameter based on neural network in textile industry. The typical economy parameter and representative parameters are shown in the table 1.

TABLE 1 THE TYPICAL ECONOMY PARAMETER AND REPRESENTATIVE PARAMETERS

Number	C_{11}	C_{12}	C_{13}	C_{14}	C_{21}
Typical index	GDP index	GNP index	total import	total out port	tax
Number	C_{22}	C_{23}	C_{24}	C_{25}	C_{26}
Typical index	tariff	Input tax	Output tax	VAT	Adjust value
Number	C_{31}	C_{32}	C_{33}	C_{34}	C_{35}
Typical index	CPI	FDI	KPI	profit	per capita disposable annual income of urban households
Number	C_{36}	C_{37}	C_{38}	C_{39}	Other
Typical index	Per capita cash income of farmers and herdsmen	Foreign Exchange Reserve	Stock of money	investment	Other

The data obtained by questionnaire survey and data simulation analysis is disposed by using neural network algorithm in the chapter 3. According to the actual needs, set the upper limit of iterations of the particle swarm and the largest scale, as well as set the initial velocity and position of particles randomly. To update the velocity and position of the particle timely, and save the difference of the adaptive value between individual particles and particle swarm. According to the error limit and the upper limit of iterations, if the error of the system adaptive value exceeds one of them, the training is over; at this time, the original global optimal value of particles is the optimal weights and thresholds which are needed by the BP neural network. The experiment value of the typical economy parameter is shown in the table 2.

TABLE 2 THE EXPERIMENT VALUE OF THE TYPICAL ECONOMY PARAMETER

Number	C_{11}	C_{12}	C_{13}	C_{14}	C_{21}	C_{22}	C_{23}	C_{24}	C_{25}	C_{26}
1	1	0.8	0.8	0.8	1	0.8	0.85	0.8	0.72	0.8
2	1	1	0.8	0.8	1	0.9	0.85	0.8	0.77	0.8
…	…	…	…	…	…	…	…	…	…	…
49	0.2	0.4	0.2	0.2	0	0.3	0.3	0.2	0.27	0.2
50	0.8	0.8	0.4	0.6	1	0.5	0.6	0.6	0.64	0.6
Number	C_{31}	C_{32}	C_{33}	C_{34}	C_{35}	C_{36}	C_{37}	C_{38}	C_{39}	Expected output
1	0.92	0.87	0.85	0.8	0.93	1	0.8	0.8	0.9	0.85
2	0.93	0.9	0.9	1	0.95	1	0.8	0.6	0.9	0.88
…	…									…
49	0.33	0.37	0.25	0.2	0.35	0	0.2	0.2	0.4	0.24
50	0.75	0.77	0.8	0.6	0.78	0	0.6	0.4	0.7	0.63

Time series analysis is to extract useful information from the order information, which is an important mathematical statistics branch. After the recovery of the questionnaire, the use of total correlation and T-test method for analysis, T test were significant level (ie, $P<0.05$), while the total relevant levels have reached a significant level (ie, $P<0.05$). Finally it retain all entitled later analysis for the most preparation. First hypothesis test reliability for each subscales and total scale reliability was Cronbach's factor. When the reliability of $x>0.7$, it means that reliability is quite high. When $0.35<x<0.7$, it indicates the general reliability. When $x<0.35$, it indicates low confidence. This questionnaire forward style title five levels x coefficients were: tangible factor of 0.85, reliability coefficient of 0.82, response coefficient 0.74, protection coefficient was 0.66, empathy factor of 0.80 and total scale factor of 0.86. From the result above, it shows that the prediction system of typical economic parameter based on neural network can improve the performance of textile industry development prediction and has played a certain role in promoting the development of the industry.

V. CONCLUSION

The textile industry is a huge contributor to the steady development of the national economy; it also has a long-term influence on the world. To date, the textile industry in China is in a critical period of structural adjustment. Aiming at improving the development of this industry, the author researched on the application of prediction system of typical economic parameter based on neural network in textile industry. The prediction system of typical economic parameter is used for solving the problem of development prediction in textile industry while the neural network algorithm is used to improve the accuracy and efficiency of the prediction system.

The environment of the fabrics trade liberalization is: relevant protocol of the fabrics trade and TBT (Technical barriers to trade). 20 typical economic indicators to study prediction system of typical economic parameter based on neural network in textile industry are selected and the data obtained by questionnaire survey and data simulation analysis is disposed by using neural network algorithm. This questionnaire forward style title five levels x coefficients were: tangible factor of 0.85, reliability coefficient of 0.82, response coefficient 0.74, protection coefficient was 0.66, empathy factor of 0.80 and total scale factor of 0.86 which shows that the proposed method can improve the performance of textile industry development prediction.

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