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A New Class of the Selection Algorithm for Supplier of Tobacco Enterprise Based on Principal Component Analysis Complex System and BP Neural Network

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Abstract

With the accelerated globalization of the world economy and intensified tobacco control movement, Corporate restructuring and global expansion of transnational tobacco enterprise is accelerated. In this paper we establish a two-way game model of distribution companies and suppliers in order to meet today's fierce competition, and study the influence of customer's preference on tobacco price. We have creatively make in-depth analysis of customer groups and the tobacco industry pricing strategy. We consider customer preference as a constraint of the model, in this context research the tobacco enterprise's dynamic pricing. And we use BP neural network and Principal Component Analysis to evaluate the supplier of the supply chain. After that, we use the actual data from the Yantai tobacco enterprises to carry out a fitting analysis of the model and we find that it is very critical for a tobacco circulation to select tobacco suppliers, so the establishment of a new BP algorithm combined with principal component analysis to analyze and select the supplier has important practical significance. At the end, we summarize the whole paper and find the conclusion that the Chinese tobacco companies should follow the trend to accelerate the pace of reform, implementing dynamic pricing mechanism, adjusting the business scale, selecting suppliers reasonable. This is the only way to grow their own, and to improve international competitiveness.

Keywords*: economic integration, tobacco market, the pace of reform*

1. Introduction

In recent years, with the tobacco industry enterprises strongly integration by the State Tobacco industry authorities, a series of measures was designed to promote mergers and acquisitions among tobacco enterprises to improve their situation. The integration of tobacco brand has made great achievements. Because of supportive policies, future acquisitions and restructuring of tobacco enterprises will continue to advance, while the tobacco market will maintain the basic stability of the state, the tobacco companies will pay more attention to the cigarette brand integration and expansion.

The development of the tobacco industry not only accumulate a lot of wealth, but also ease the employment pressure. Led to the development of agriculture-related businesses, and for the state to create a lot of foreign exchange earnings (Kao, 2006, Tang, 2005). Development of China's tobacco industry has both ecological resources, market resources, material resources and social resources advantage, but also has the quality, scale, concentration, competition and talent-building disadvantage (Xuan et al. 2000).

At the same time, the tobacco industry tax on which local governments rely, market-oriented production, planned quota distribution system which is not coordinated, leaf tobacco purchasing price rigidity, the lag of tobacco market obvious regional characteristics and brand building, etc., these trouble are the important factors restricting

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the development of tobacco industry in China at present (Al-Bayat and Hussein,2010, Liu et al. ,2010). Although China's tobacco production and sales accounted for 1/3 of the world, in terms of numbers, there is no doubt that a tobacco country (He and Xiang, 2004). But compared with developed countries, China also has the very big disparity in brand building and marketing strategy, therefore, is not a tobacco power.

There has been a lot of research on tobacco supply chain and BP neural network. Hen and Zhang (2005) researched the management of the subsidiary material to tobacco suppliers. Huang, X. and Su, Y. (2009) investigated how system dynamics modeling could be supportive for tobacco supply-chain management, and analyzed the behavior of the tobacco supply-chain management through a simulation model based on the principles of the system dynamics methodology. Chen, C. (2014) established a collaborative pricing model based on a complete information dynamic game and studied the tobacco supply chain procurement risk conduction based on elastic coefficient. Li, J.M. et al. (2005) presented a recognition method based on principal component analysis and back-propagation neural network. Gong, H.P. et al. (2011) investigated the evaluation on information sharing level between manufacturer and supplier based on BP neural network. Qiuzan, Z. et al (2013) studied the application of fuzzy comprehensive judgment and gray correlation analysis in tests for newly-introduced peanut varieties. Bing, H. and H. E. (2014) discussed the construction of supply chain logistics in tobacco industry.

Therefore, this article selects from tobacco pricing, scale model of tobacco enterprises and suppliers' analysis of three aspects of modeling, designed to some extent compensate for the lack of relevant research.

2. Materials and Methods

The tobacco enterprise's dynamic pricing based on customer preference: The value of the enterprise is decided by the majority of customer's satisfaction with no exception. Thus, we should price tobacco products around customer. First, enterprise should understand customer preferences for products, in this paper, we studied in depth and established a tobacco distribution enterprise and suppliers of two-way game model, focusing on the customer's preference for tobacco price impact.

Among them, p_0 is the ideal price for the buyer, and α, β are the price multiplier and quality multiplier. Here we assume $z_i \in [0,1]$.

Under such assumptions, we establish the following game model:

$$\max\{\frac{p_j + E[p_i(\alpha) \mid p_i \geq p_j(c)]}{2} - c\} = u_i$$

For $p_0 \in [0,1]$

$$\min\{\alpha \mid p_0 - \frac{p_j + E[p_j(\alpha) \mid p_j \leq p_i(c)]}{2} + \beta p_j\} = u_j$$

In this study, the object of study is a linear game, Myerson has found: If the game obeys uniformly distributed, then, if the game player takes a linear game model, you can get the maximum benefit, while the income by other Bayesian equilibrium state is not high.

Thus, we can know:

$$p_i = \frac{\alpha q_i}{4\beta} + 0.25 + 0.6c \qquad p_j = \frac{3\alpha q_i}{4\beta} + \frac{1}{12} + 0.6u_i$$

Thereby, you can get if you take

a linear game model, you can get the maximum benefit. Then their transactions was the middle part surrounded by the two curves, p_i and p_j. Because of the criteria for equilibrium conditions, when $p_i \geq \frac{1}{4} + \alpha p_j - c$ we will have a transaction.

Scale model of tobacco enterprises under the constraints of smokers: Tobacco enterprise scale associated with the population's constraints of smokers, with mutual restriction and influence, first, adequate supply of smokers supported the expansion and growth of tobacco enterprise scale, secondly, the expanding size of the economy stimulated the development of tobacco products, the short-term supply of tobacco is certain, but in the long term, as the economy grows, demand will stimulate the economy to develop the new tobacco product supply.

"Population constraint" is used to describe a constraint on economic growth because of population bottleneck, which is in the process of tobacco enterprise operating, since smokers' population increased slowly, and come into restricting of total tobacco enterprise scale.

In contemporary China, like the city Yantai, after joining the WTO, have occasion to achieve rapid economic growth, but the number of smokers has not increased too much, the main unit of smokers' consumption increased, at the same time, the number of smokers is no growth or even declining, a constraint on the population of smokers is in the increasingly strengthened. Faced with this economic situation, we propose the following basic assumptions：

Assumption 1: Assuming the total size of the tobacco business $UQ(t)$ is an increasing function of time t, set at the time t_0, made in increments of time Δt, corresponding, for the tobacco business enterprise, an incremental scale of its tobacco business is $\Delta UQ(t)$, assuming that if the number of smokers in the supply is $+\infty$, $\frac{dUQ(t)}{dt} = b$.

Assumption 2: Assuming the total population which can take advantage of the development of the tobacco enterprises' scale is S, it mainly refers to the tobacco business scale to support the growth of the total. With $UQ(t)$ no expansion, the fatigue of S reserve growth, or even declining, if we do not change the economic growth mode. Unit possession of resources in the region will continue to reduce, the relative lack of smokers will restrict $UQ(t)$'s further growth, and there is when the $t \to +\infty$, $UQ(t) \to$ upper limit of $\max UQ(t)$.

Assumption 3: With the assumption of $UQ(t)$ grown, the number of smoker's constraint will become increasingly evident on bottleneck effect for the role of economic growth. That incremental scale $\Delta UQ(t)$ for tobacco business will be increasingly limited with $UQ(t)$ increase.

Model building: We get the total economy incremental when the number of smokers is unlimited

$$\Delta UQ(t) = bUQ(t)\Delta t \qquad (1)$$

We get the "constraint parameter" when tobacco business scale grown

$$SH = [1 - \frac{S/UQ_{\max}}{S/UQ(t)}] \qquad (2)$$

By definition, $0 \leq SH \leq 1$ can be obtained. And the variable SH and variable $UQ(t)$ change in the opposite direction. Formula (2) possession of resources from per unit of GDP decline with $UQ(t)$ growing.

And the tobacco business scale growth equation can be obtained from assumption 3.

$$\Delta UQ(t) = bUQ(t) \cdot SH \cdot \Delta t \qquad (3)$$

In this formula, $bUQ(t)$ reflecting the fact that $UQ(t)$ growth rate is b when the operating scale of tobacco enterprise without resources supply constraints; and

$SH = [1 - \frac{S/UQ_{\max}}{S/UQ(t)}]$ reflects the number of smokers and business scale of tobacco enterprise constraints, as the total economy expanding, in the case of consumer preferences have not changed, $SH = [1 - \frac{S/UQ_{\max}}{S/UQ(t)}]$ will be reduced accordingly, so that in the size of the incremental tobacco business $\Delta UQ(t) = bUQ(t) \cdot SH \cdot \Delta t$ will be corresponding reduced.

Raised tobacco enterprise management plan Yantai tobacco companies, the scale of its tobacco business development equation is

$$U(t) = \frac{n}{1 + ke^{-bt}}$$

The equation $U(t) = \frac{UQ(t)}{TQ}$ represents the level of economic development of the city at the moment t.

There is its derivation:

Equation (3) is divided by Δt both sides at the same time, and to make Δt tends to 0, we get

$$\frac{dUQ(t)}{dt} = bUQ(t) \cdot SH \tag{4}$$

Since Eq. (2) we can obtain

$$\frac{dUQ(t)}{dt} = bUQ(t) \cdot [1 - \frac{S/UQ_{\max}}{S/UQ(t)}] \tag{5}$$

Obviously Eq. (5) is equivalent to the following formula

$$\frac{dUQ(t)}{dt} = bUQ(t) \cdot [1 - \frac{UQ(t)}{UQ_{\max}}] \tag{6}$$

Further, while the left and right sides of the equation is both divided by a, we can obtain,

$$\frac{dUQ(t)/TQ}{dt} = b\frac{UQ(t)}{TQ} \cdot [1 - \frac{UQ(t)}{UQ_{\max}}] \tag{7}$$

Obviously the Eq. (7) and the following Eq. (8) are equivalent

$$\frac{dUQ(t)/TQ}{dt} = b\frac{UQ(t)}{TQ} \cdot [1 - \frac{UQ(t)/TQ}{UQ_{\max}/TQ}] \tag{8}$$

Set $n = \frac{UQ_{\max}}{TQ}$, then Eq. (8) is equivalent to the following formula

$$[\frac{1}{n - U(t)} + \frac{1}{U(t)}]\frac{dU(t)}{dt} = b \tag{9}$$

Eq. (9) on both sides at the same time take the integral, we can obtain

$$\ln\frac{U(t)}{n - U(t)} + c_1 = bt + c_2 \tag{10}$$

In this one, c_1, c_2 are arbitrary constants, by solving (10), we can obtain

$$U(t) = \frac{n}{1 + e^{-bt} \cdot e^{(c_1 - c_2)}} \tag{11}$$

We make $k = e^{(c_1 - c_2)}$, and we can get:

$$U(t) = \frac{n}{1 + ke^{-bt}} \tag{12}$$

This equation shows a process that the tobacco company's business scale continuous change with the time.

It can be seen, with the growth rate for smokers slow down, or even reduce, the business scale of tobacco enterprise will face enormous challenges, tobacco companies should focus on reducing the consumption elasticity of their products, on the one hand, they can increase their visibility through advertising; on the other hand, they should increase the cooperation with well-known tobacco enterprise, increase brand effects, to deal with smokers reduce, and increase sales, win in the competition.

3. The Selection of Tobacco Enterprise Supplier

As the development of technology, information and economic globalization, the activities of enterprises have been become more and more international. The relationship between the enterprise and its suppliers' changes greatly, from the buyer-seller relationship to the partnership. In today's environment of supply chain management, the cooperation among the enterprises has become the core of the supply chain. The tobacco enterprises have to manage their suppliers in a new way. So how to choose manage the tobacco suppliers have become the important issues for the tobacco enterprises. The evaluation of tobacco supplier is an important part of the supply chain management. The selection will largely determine the running of the supply chain.

In this paper, we use BP neural network and Principal Component Analysis to evaluate the supplier of the supply chain. The main advantage of BP neural network is that the researcher can process data freely and concurrently. In addition, the method has a strong ability to access and process information, the random uncertainty shortcomings addition to subjective evaluation, free from the uncertainty of subjective factors.

However, the learning algorithm which is used to determine the weight in traditional BP neural network algorithm is based on gradient descent, it is inevitable that computation time is too long and infinite loop is familiar. To solve the problem, this paper uses principal component analysis to compress the data in advance, in order to explain the multivariate variance by a handful of main component. This will not only improve the accuracy, but also reduce training time and simplify the network structure.

The Introduction of the Principle:

Principal component analysis: The principal component analysis extracts information from the observable variable, to compose implicit variable which cannot be observed directly. It makes the variance be biggest, to keep the information contained in the original variables as much as possible. Replacing the original variables by the main ingredients as less as possible, it can make the problem become simple. This method is mainly based on the idea of the orthogonal transform, retaining the feature vectors which have a significant contribution.

Suppose $X_1, X_2, X_3, \cdots\cdots, X_p$ as p variables of a practical problem $X = (X_1, X_2, \cdots\cdots, X_p)^T$. Σ is the covariance matrix of X. The eigenvalue of Σ is $\lambda_1 \geq \lambda_2 \geq \cdots \geq \lambda_p \geq 0$. The orthogonal unitized eigenvectors is $e_1, e_2, \cdots, e_p$. The ith principal component of X is $Y_i = e_i^T X = e_{i1}X_1 + e_{i2}X_2 + \cdots + e_{ip}X_p$,

$i = 1, 2, \cdots, p$. The contribution rate is the principal component share of the total information. For example, the contribution rate of the kth principal constituent Y_k is $\lambda_k / \sum_{i=1}^{p} \lambda_i$ .The contribution rate of first principal constituent is the greatest, which is indicate that $Y_l = e_i^T X$ has a better ability to contain information. The sum of contribution rate of first m principal constituent is $\sum_{i=1}^{m}\lambda_i / \sum_{i=1}^{p}\lambda_i$, which is called as accumulative contribution rate. In general, we select $m < p$, making the proportion of cumulative of contribution rate of the first m principal components be the most (more than 80%). Therefore, we can reduce the number of dimensions and contain the information in the original variables at the same time.

The principle of BP neural network: Since the 1980s, artificial neural network method has attracted attention as its unique advantages; the basic idea is to simulate the nervous system of the human brain from the perspective of bionics, so that it has the ability to learning and reasoning as the human brain. In the area of control, the advantages of neural network are that, it can fully approach and deal with complex nonlinear relationship; it can learn and adapt to the dynamic characteristics of the uncertain system; all quantitative or qualitative information is stored in each unit of the network, so it is robustness and fault tolerance; it uses parallel distributed processing methods, makes it possible to do a rapid intensive computing. These features show the great potential of a neural network in solving nonlinear and uncertain system control problem. We use back propagation neural network (BP) algorithm to predict output value of tobacco of Yantai City.

Design ideas of algorithm: To compensate the shortcomings of the BP neural network algorithm, this paper improves BP neural network algorithm which evaluates the suppliers. The main idea is, to build a new BP algorithm based on particle swarm and the BP neural network. In this paper, traditional algorithm has been improved in two ways to build the new BP algorithm (Fig.1).

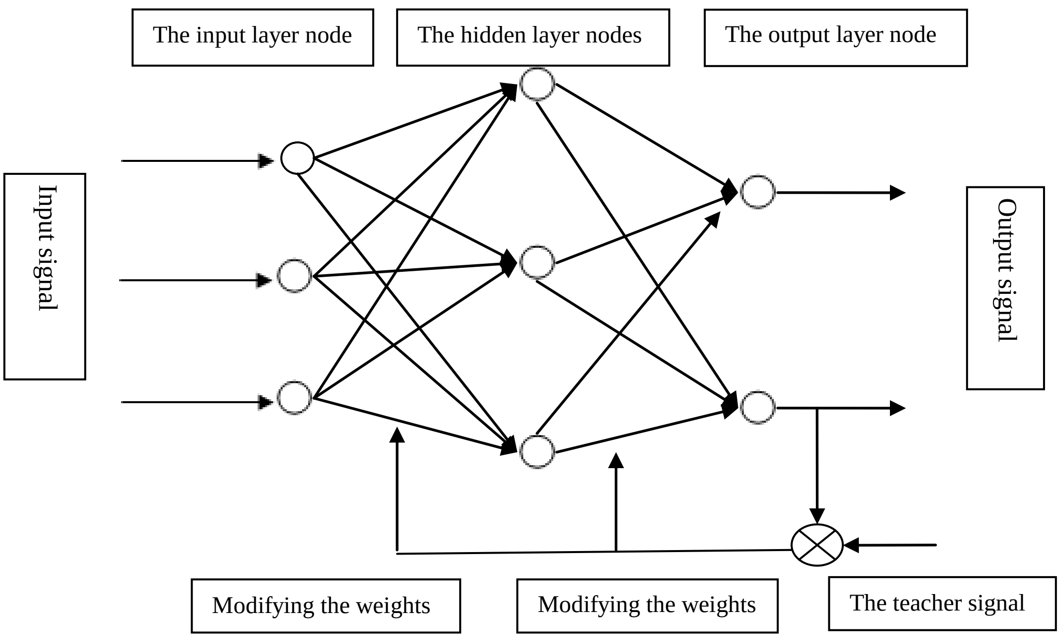

Figure 1. BP Neural Network Algorithm based on Network Integration

Firstly, the traditional algorithm uses all indicators system as the input vector. The new BP algorithm, use principal component analysis, to determine the number of the input vectors of the ending of the BP neural network. To achieve such improvements, after appropriate transform of matrix function, the original variable is converted into a linear combination of the new variable. Sequentially select the vector with bigger weighing value as the input vector to a linear combination. Finally using principal component analysis method to evaluate, in order to remove the extra vector information, which greatly speeds up the computation of the algorithm?

Secondly, in the traditional BP neural network algorithm, weights and thresholds are formulated subjectively by the operator. This paper uses maximum descent method to calculate the weights. The disadvantage is that it is very easy to make the calculation be slow, and convergence to a local minimum. The new BP algorithm uses weight values or threshold of mapping of each particle to calculate weights. The new BP algorithm weakens the demand function and the program which can integrate the function, in the traditional BP neural algorithm method; it reduces cross dispersion variation alienation operations in the traditional method, which improves the operational efficiency of the neural network.

The new BP-algorithm combined with principal component analysis

Step 1. Obtain a_{ij} in the correlation matrix, by standardized the data in the evaluation index system

Step 2. Calculate the eigenvalues of M by Mathematica.

Step 3. Obtain k main factors, the model of action rate is:

$$p_k = \frac{\alpha_k}{\sum_{i=1}^{p} \alpha_i}$$

We use the main factors when action rate is 0.75.

Step 4. By screening the main factors in the evaluation index system, the paper determines weights, thresholds, and the number of the neurons in each layers in the BP neural network.

Step 5. Initialize the parameters in the BP neural network, such as the number, dimension, weight, and threshold.

Step 6. Randomized trial: generate a random number in the data space as the determined parameters, obtain samples, and then calculate.

Calculation error is determined by the following formula:

$$V_a = (X_a - x_a)^2$$

x_a is the mathematical expectation.

Step 7. Analysis of the velocity of the particles in the layers of neurons, and calculate to get optimal value.

If $P < P_0$, then $\beta_i = P_d$. P indicates the current speed, while P_0 indicates the initial local optimum value.

If $P > P_0$, then $\beta_i = P_g$. P indicates the current speed, P_g indicates the optimal speed value of neurons of each layers in BP neural network.

Step 8. Adjust initial displacement of each part.

This paper uses the formula given below to adjust the initial value:

$$s_i(t+1) = \lambda s_i(t) + (1-\lambda)Rand[1,2]$$

$$(p_d - p_0) + Rand[1,2](p_g - p_0) = \beta_i$$

Where $Rand[1,2]$ indicates random value of the corresponding parameters of the particle.

We use the following model to calculate the threshold value $Y_i(t+1) = Y_i(t) + \beta_i$, $\mu > 0$ indicates Inertial coefficient. The changes of μ are from rational self-regulating adjustments, and μ is calculated by PSO algorithm. Then we can get the global value $Y_i(t)$.

$$\mu = \mu_{\max} - (\mu_{\max} - \mu_{\min})\frac{r}{r_{\max}}$$

Where $\mu_{\max}$ and $\mu_{\min}$ denotes the minimum and maximum values of the weights respectively. In this paper, $\mu_{\max}$ =0.85 and $\mu_{\min}$ =0.3. r indicates the number of operations

Furthermore, in the population of neurons of the BP neural network the speed v_i need to meet the following conditions：

If $v_i(t+1) < v_0$,then $v_i = -v_0$, v_0 indicates the maximum.

If $v_i(t+1) > v_0$,then $v_i = v_0$, v_0 indicates the maximum.

And then use the following algorithms to obtain the Initial displacement and initial velocity.

If $s_i(t+1) < s_0$, then $s_i = -s_0$, s_0 indicates the maximum.

If $s_i(t+1) > s_0$, then $s_i = s_0$, s_0 indicates the maximum.

Analysis of the new BP algorithm: Theorem 1: We use particle swarm calculated to set weight: $\phi = \phi_1 + \phi_2$, where $\varphi_1 = (1-\lambda)Rand[1,2]$, $\phi_2 = Rand[1,2](p_g - p_0)$, we can get the best weight values when $1 < \phi < 2$.

Proof: When the number of iterations is a, the calculation formula is:

$$s_i(t+1) = \lambda s_i(t) + (1-\lambda)Rand[1,2] \quad (13)$$

$$(p_d - p_0) + Rand[1,2](p_g - p_0) = \beta_i \quad (14)$$

$$Y_i(t+1) = Y_i(t) + \beta_i \quad (15)$$

$$\mu = \mu_{\max} - (\mu_{\max} - \mu_{\min})\frac{r}{r_{\max}} \quad (16)$$

So we can get that:

$$v_i(t+1) = \mu v_i(t) - \phi s_i(d) + \beta_i$$

$$s_i(t+1) = (1-\mu)s_i(t) - \mu s_i(d)$$

Use particle swarm calculated to get the best weight:

$$\gamma = 1 + \phi + \sqrt{(\phi - \mu)^2 - 4\mu}$$

4. Result and Discussion

Numerical Simulation: The case studies Yantai Tobacco Company, which is a large state-owned commercial enterprise in Yantai City, Shandong Province. The company has the exclusive right of the tobacco in Yantai. The company's upstream suppliers are throughout the country, including the local enterprises in Shandong. The evaluation of the supplies is mainly based on the following aspects: delivery time, quality of tobacco, price, and supplier's development momentum.

First of all, we give the evaluation target value of the upstream tobacco providers.

Table 1. Evaluation Points of Tobacco Suppliers

The suppliers	A1	A2	A3	A4	A5	A6	A7
evaluation points	0.8	0.66	0.54	0.78	0.83	0.73	0.69

Table 2: evaluation points by traditional BP-algorithm

The suppliers	A1	A2	A3	A4	A5	A6	A7
Output	0.782	0.65	0.58	0.71	0.85	0.77	0.8
Error	0.18	0.1	-0.4	0.7	-0.02	-0.04	-0.11

Table 3: evaluation points by the new BP-algorithm

The suppliers	A1	A2	A3	A4	A5	A6	A7
Output	0.792	0.67	0.57	0.72	0.82	0.76	0.7
Error	0.08	-0.1	-0.3	0.6	0.01	-0.03	-0.01

Table 1 presents the evaluation points of tobacco suppliers. We can find that seven suppliers can be divided into three grades, the first class includes A5 and A1; the second class includes A4 and A6, and the last class includes A2, A3 and A7. Table 2 and Table 3 present the evaluation points by traditional BP-algorithm and the new BP-algorithm. Comparing the two tables with table 1, it can be seen that, the difference between suppliers' ratings and the target value is smaller when we use the new BP algorithm evaluation combined with principal component analysis. The reason is that the new BP algorithm is more advanced than traditional BP algorithm, while the error still exists. According to a statistical knowledge, when the sample size reaches a certain quantity, the error will be further reduced, and the final structure will be more reasonable.

The new BP algorithm combined with principal component analysis uses a lot of expert knowledge in the calculation process, thereby reducing the subjective random phenomenon, to make up for the shortcomings of competent random phenomenon which is highlights in the existing supplier system. It can be used to evaluate all new suppliers.

5. Conclusion

For the entire distribution process of tobacco industry, tobacco supplier selection is a very important part. Therefore, the establishment of a new BP algorithm combined with principal component analysis to analyze and select the supplier has important practical significance

References

[1] M. A. Al-Bayati and K. Q. Hussein, "Evaluating the efficiency of the instructional websites 'which are oriented to the deaf students' according to the technical criteria", Journal of Convergence Information Technology, vol. 5, no. 2, **(2010)**, pp. 138 - 145.

[2] H. Bing and H. E. Mu, "On construction of supply chain logistics in tobacco industry", Acta Tabacaria Sinica, **(2014)**.

[3] C. Chen, "Study on Tobacco Supply Chain Procurement Risk Conduction Based on Elastic Coefficient", Industrial Engineering and Management, vol. 1, no. 24, **(2014)**.

[4] R. X. Chen and W. Y. Zhang, "The Research on the Management of the Subsidiary Material to Tobacco Suppliers", Journal of Kunming Metallurgy College, vol. 6, no. 18, **(2005)**.

[5] H. P. Gong, Y. Gong and L. N. Yuan, "Evaluation on Information Sharing Level Between Manufacturer and Supplier Based on BP Neural Network", Journal of Modern Information, vol. 1, no. 31, **(2011)**, pp. 40-43.

[6] X. Huang and Y. Su, "Quantitative Models for Operational Risk to Implement Tobacco Supply-Chain Strategies", In Cooperation and Promotion of Information Resources in Science and Technology, COINFO, Fourth International Conference, **(2009)**.

[7] Y. He and L. G. Xiang, "Study and Application of BP Neural Network Model Based on Fuzzy Clustering", Systems Engineering-theory & Practice, no. 2, vol. 14, **(2004)**, pp. 79-82.

[8] C. Kao, "Interval efficiency measures in data envelopment analysis with imprecise data", European Journal of Operational Research, vol. 174, no. 2, **(2006)**, pp. 1087-1099.

[9] J. M. Li, Y. H. Hu and X. H. Tao, "Recognition method based on principal component analysis and back-propagation neural network", Infrared and Laser Engineering, vol. 6, no. 34, **(2005)**, pp. 719-723.

[10] T. T. Liu, X. Hong and W. Y. Guo, "Application of PCA to Diesel Engine Oil Spectrometric Analysis", Spectroscopy and Spectral Analysis, vol. 3, no. 30, **(2010)**, pp. 779-781.

[11] W. M. Tang, "The Study of the Optimal Structure of BP Neural Network", Engineering-theory & Practice, vol. 10, **(2005)**, pp. 95-100.

[12] C. T. Xuan, P. Q. Huang and D. Lu, "Applications of Neural Network Technology in Supply Chain Management", Industrial Engineering and Management, vol. 3, **(2000)**, pp. 41-44.

[13] Z. QiuZan, C. RongHua, F. XianLan, S. C. You, Y. K. Yang, H. S. De and C. Y. Xing, "Application of fuzzy comprehensive judgment and gray correlation analysis in tests for newly-introduced peanut varieties", Acta Agriculturae Jiangxi, vol. 25, no. 1, **(2013)**, pp. 11-14.