The Economic Evaluation for Productivity Construction of Shore Oil Field based on BPNeural Network

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Abstract. Oilfield productivity construction is the first step of production of onshore oil field. Its investment effect directly influences the whole oilfield company's economic benefits. So the comprehensive and accurate economic evaluation is critical to oilfield productivity construction project. This paper collected 20 similar projects and according to the principle of BP neural network and screened 9 influence and restrict the development factors to the economic benefit of productivity construction project as the input indexes of the neural network. It is proved by simulation calculations that the model has higher identification precision. Therefore, the neural network has good application prospect in oil economic evaluation.

Introduction

Oil is one of the most important energy in the 21st century. Therefore, how to strengthen the ability of meticulous management for productivity construction improve development efficiency becomes particularly important[1-2].

There are lots of commonly used methods of economic evaluation such as Cost Benefit Analysis, analytical hierarchy process (AHP) method and fuzzy comprehensive assessment at present[3-9]. But the analytic hierarchy process, fuzzy comprehensive evaluation methods mostly have complex process and are influenced to some random and subjective factors. This paper introduced BP neural network to the economic evaluation, to make up the defects of AHP, fuzzy comprehensive evaluation method that estimate weights subjectively, so that methods of economic evaluation is more rich.

Building project economic evaluation model based on BP neural network

The BP neural network model's highly non-linear approximation, generalization capability and adaptive ability and other characteristics make the process to avoid the influence of subjective factors such as setting the index weight artificially.

Establish the project economic evaluation index system. For as many angles as possible taken into consideration to conduct a comprehensive economic evaluation,we set up the index system as follows:

Table 1The economic evaluation system for productivity construction of on shore oil field

Classification index	typed pointer	Index name and unit	symbolic
Input index	reservoir evaluation	buried depth(rice)	p_1
	Reservesvaluation index	recoverable reserves（10000 ton）	p_2
		average water cut（%）	p_3
	economic benefit evaluation index	investment per ton of production capacity（hundred million）	p_4
		annualunit cost（yuan/ton）	p_5
		annualunit operation cost（yuan/ton）	p_6
		single wellinvestment（10000 yuan）	p_7
		crude oil price（yuan/ton）	p_8
		crude oil commodity rate（%）	p_9
Output index	finance evaluation index	IRR（%）	q_1
		Dynamic investment recovery period（year）	q_2
		net annul value（1000 yuan）	q_3
	society evaluation index	employment effect（%）	q_4
		economic cost-benefit level of	q_5

Among them, the employment effect index calculated by number of new jobs / total investment of a project. The economic cost-benefit level of environmental impact =(resources consumption fee of project environment +disaster loss fee of project environment + pollution loss fee of project environment）/ economic benefit[10].

The selection of training samples and data preprocessing. Put the parameter values of main factors which influence the economic benefits of the oilfield production capacity construction (p1, p2, p3, p4, p5, p6 , p7 p8, p9) as the input, and put the project economic and social evaluation index (q1, q2, q3 , q4, q5) as the output of the network. This paper collected 20 group productivity data of projects which have completed for network training and simulation.

Because the above index system of the indicators is less relevant, it should be transposed and normalized the input and output samples which have transposed respectively.

Determining the parameters of the network structure.(a) Network Layer: using a hidden layer. Network architecture comprises an input layer, a hidden layer and an output layer.(b) Input layer nodes: the input index number, nine.(c) The output layer nodes: the desired output index number, five.(d) The number of nodes in the hidden layer:In this paper, we choose trial and error method to determine the number of hidden nodes as the initial value of the trial and error method by using the following empirical formula.

$L=\sqrt{m+n}+\partial$ (1)

$L=\sqrt{mn}$ (2)

$l=\log_2 n$ (3)

Among them:m is the number of nodes in the hidden layer; n is the number of nodes in the input layer; l is the number of nodes in the output layer; a is the constant between 1 and 10.

Choice the training function. There are lots of learning algorithms in MATLAB BP neural network toolbox. It is found that the number of its rations under various functions to achieve convergence is similar, so we choose the proportion between the number of the output error which is more than 10% and the number of output under random training in each function for 15 times as the evaluation standard. The results are as follows:

Table 2Comparison training result of five functions

training function	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	ratio
trainbfg	48	29	43	49	38	39	68	68	34	46	76	36	83	48	58	50.83%
traingdx	41	29	21	46	79	61	67	81	52	79	66	51	79	67	37	57.33%
trainlm	32	31	19	29	59	19	26	29	31	26	74	82	17	47	71	38.25%
trainrp	71	48	78	39	53	34	64	43	26	56	79	88	44	49	54	53.92%
trainscg	19	47	44	86	51	42	51	71	42	32	34	27	29	62	31	41.75%

Results show that the number of errors which is greater than 10% using trainlm function is less than 30 and its proportion is also the smallest, so we choose trainlm.

Network training and testing

In order to compare conveniently, the paper made the output results of network anti- normalized and reverted it to original units. In turn, we can draw the error simulation between output and actual output value:

Table 3 Part of error between the output of network and actual result

Project number	1	2	3	4	5
IRR	7.5085%	-3.5308%	-5.4542%	-11.6565%	5.1124%
Dynamic investment recovery period	-1.0181%	-13.9602%	-7.6423%	-6.0958%	-2.2747%
net annul value	-12.0889%	-3.1357%	-3.6742%	7.0437%	1.6283%
employment effect	-2.6067%	-0.3376%	6.4103%	6.4762%	3.4510%
economic cost-benefit level of environmental impact	2.1064%	8.1085%	6.1042%	-3.2213%	-8.2660%
Project number	6	7	8	9	10
IRR	5.3411%	2.2468%	7.4913%	5.6845%	-14.1534%
Dynamic investment recovery period	3.5124%	-0.9934%	7.2758%	-0.3021%	-4.5368%
net annul value	6.0071%	0.9158%	2.3409%	-0.6713%	-6.2490%
employment effect	-6.7262%	-4.3307%	-7.6315%	-2.9372%	-8.2958%
economic cost-benefit level of environmental impact	1.3402%	-14.8597%	5.7641%	-6.8748%	3.5779%

There are only seven errors of output data are more than 10% to the actual output value in all 100 simulation output data, and these are all no more than 15%.

Conclusions

In this paper, we built a new economic evaluation system based on the existing production-building onshore oilfield project. And through lots of training and simulation about relevant data of 20 oil fields which have been completed, finally established a high precision economic evaluation model based on BP neural network. It indicated that the BP neural network model which we established has a high training accuracy, which can achieve the purpose of forecasting.

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