

Retraction

Retracted: Forecast and Evaluation of Educational Economic Contribution Based on Fuzzy Neural Network

Complexity

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

- (1) Discrepancies in scope
- (2) Discrepancies in the description of the research reported
- (3) Discrepancies between the availability of data and the research described
- (4) Inappropriate citations
- (5) Incoherent, meaningless and/or irrelevant content included in the article
- (6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

- [1] R. Liu and M. Wu, "Forecast and Evaluation of Educational Economic Contribution Based on Fuzzy Neural Network," *Complexity*, vol. 2021, Article ID 1056295, 11 pages, 2021.

Research Article

Forecast and Evaluation of Educational Economic Contribution Based on Fuzzy Neural Network

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According to the theory that the degree of education of workers in educational economics has a certain positive relationship with social labor productivity, the fuzzy system and neural network modeling mechanism are used to establish the fuzziness of laborers' education level to social productivity (per capita national income). This article combines fuzzy theory and neural network theory to construct an empirical model for the analysis of the contribution of education economy and conduct an empirical analysis of statistical data from 2010 to 2020. Analysis shows that there is a great correlation between per capita years of education and per capita GDP, especially the number of college students per million people has a greater correlation with per capita GDP. This fully confirms that economic growth is increasingly dependent on education, especially higher education. The main body of this article is the improvement of the measurement model and the calculation of the contribution of our country's education to economic growth using the fuzzy neural network measurement model. The final empirical conclusion shows that education has a significant role in promoting the development of our country's economy.

1. Introduction

Based on the basic theories of Marxism, drawing on the useful experience of Western economics and combining the reality of our country's education and economic development, they proposed the statistical measurement method of "education-labor productivity-economic development" [1]. These methods have promoted the development of educational economics and added new content to the development of economics itself. As the cornerstones of educational economics, these theories and methods have a strong guiding significance for guiding us to understand the economic meaning of education, regardless of the past, present, or future. The basic theory of educational economics points out that "Educational economic value" is understood as the effect (use value) created by educational labor, which can promote social and economic growth and development and meet people's material and spiritual needs, which is condensed in the product of educational labor [2]. Education is the universal and undifferentiated human labor (value)

among abstract labor (value) and value-added labor [3]. In addition to its rapid local education development, it has also used the economic value condensed by foreign laborers for free; the economic development of Western countries is even more important. In this way, although there have been ups and downs, the economic role of education-sustainable development of productivity has been stable. Therefore, both theory and practice show that the degree of laborers' education has a certain positive relationship with social labor productivity [4]. The impact of education on economic growth is a typical social and economic problem. Its complexity makes it difficult to apply certain deterministic mathematical methods, and in many cases, we simply cannot construct a deterministic structural model of the relationship between the two. In this case, fuzzy theory and neural network methods are more applicable. Especially after the new millennium, the application of fuzzy theory in the evaluation of the contribution of education economy has become more and more common. Based on this, this paper combines the two methods to construct a fuzzy neural

network evaluation model for the study of the contribution of education economy. The first evaluation parameter set includes per capita gross national product; the second evaluation parameter set includes per capita gross national product, per capita fixed assets, human capital, and per capita arable land area; and the third evaluation parameter set includes education capital index, health capital indicators, empirical capital indicators, and human capital indicators [5]. The three parameter sets have their own functions. The first evaluation parameter set is used for fuzzy classification of various regions in my country; the second evaluation parameter set is used to establish the connection between human capital and the economy; and the third evaluation parameter set is used for establishing a link between education and human capital. Based on the basic theories of educational economics, this paper uses fuzzy neural network methods to study the mapping relationship between laborers' education level and social productivity (per capita national income) and soft-calculates the increase in national income caused by the increase in laborers' education level.

This paper uses statistical data from 2010 to 2019, and the analysis shows that there is a great correlation between per capita years of education and per capita GDP, especially the number of college students per million people has a greater correlation with per capita GDP. This fully confirms that economic growth is increasingly dependent on education, especially higher education. The improvement of various measurement models and the use of fuzzy neural network measurement models to calculate the contribution of the education to economic growth constitute the main content of this thesis. Through three-stage indicator selection and neural network training, the final empirical conclusions show that education has a significant role in promoting the development of my country's economy.

2. Fuzzy System Modeling Based on Neural Network

With the advent of the knowledge economy era in modern society, the promotion and acceleration effect of education on the economy has received more and more attention. However, due to the time lag, indirectness, and long-term characteristics of the economic benefits of education, it is not like the economic benefits of other factors are as easy to count and measure [6]. Therefore, the measurement of the contribution of educational development to economic growth has become a major problem faced by educational economics. According to the information we have so far, Western economists' methods of measuring the contribution of education to economic growth can be roughly divided into two categories. The first category is based on the production function and analyzes the "surplus" item in the production function and measures and evaluates the effect of education on economic growth. For example, the "residual value analysis method" of the economist Xia et al. [7] is one such method. Another category is the factor analysis method, which analyzes the factors that affect the growth of the national economy and measures the contribution of each

factor to the economic growth on this basis, so as to determine the effect of each factor on the economic growth. For example, economist Efendi et al. [8] used this method to analyze the factors of American economic growth. Scholars Liang et al. [9] generally used the "labor simplification method" to analyze the contribution of education to economic growth and believed that this is a measurement method suitable for socialist countries. This method is different from the previous two methods, and the mathematical model used is relatively simple.

Artificial neural networks are also called neural networks or connectionist models for short. They are the abstraction and simulation of several basic characteristics of the human brain or natural neural network and are designed to simulate the learning characteristics of neural cell populations [10]. The information processing system or computer system is formed by its structure and function. It is suitable for complex environments due to its strong ability to adapt to complex environments and multiobjective control requirements and to approximate arbitrary nonlinear continuous functions with arbitrary precision. The artificial neural network is based on the physiological research results of the brain, and its purpose is to simulate certain mechanisms and mechanisms of the brain and realize certain functions. It is an empirical model that mimics the functions of biological neural networks. Biological neurons receive the incoming stimulus, and their response is transmitted from the output end to other neurons connected. The transformation relationship between input and output is generally nonlinear. Wang et al. [11] an internationally renowned expert in neural network research and the founder and leader of the first neural computer company gave the definition of artificial neural network. The system processes information by responding to continuous or intermittent input. At present, many schools of neural network research methods have been formed, and the most fruitful research work includes multilayer network BP algorithm, Hopfield network model, adaptive resonance theory, and self-organizing feature mapping theory. Artificial neural network is proposed on the basis of modern neuroscience. Although it reflects the basic characteristics of human brain functions, it is far from a realistic description of natural neural networks but only a simplified abstraction and simulation of it.

3. Modeling Analysis

Neural network is an algorithm of data mining. The algorithm idea of data mining is to use machine learning to find potential laws from historical data to build a model and then apply the model to new data to predict the result. Neural network is a very mature data mining technology, and it has many applications in the fields of speech recognition, character recognition, imaging technology, pattern recognition, process control, and optimization.

Let y_i be the proportion of workers with the i -th education level ($i = 1, 2, 3, 4$) representing illiterate and semi-illiterate, elementary education, secondary education, higher education, and postgraduate education and is the input of the fuzzy system variables; f_i = per capita output value,

which are the output variables of the fuzzy system, and their corresponding fuzzy sets are as follows:

$y_i: E_{i1}, E_{i2}, E_{i3}, E_{i4} (i = 1, 2, 3, 4)$, respectively, represent the proportion of laborers in is a fuzzy set of low, medium, and high

$f_j: f_1, f_2, \dots, f_n$ is the fuzzy set of the corresponding output variables [12]

The rules are ambiguous:

$$\begin{aligned} \text{IF } E_{ij} \in \{E_{i1}, E_{i2}, E_{i3}, E_{i4}\} \subseteq C_i, \\ f_j \in \{f_1, f_2, \dots, f_n\} \subseteq U, \end{aligned} \quad (1)$$

and it is the mapping from the set $C = C_0 \cup C_1 \cup C_2 \cup C_3 \cup C_4$ to the set U .

$j = 1, 2, 3$ represent the first, second, and third industries, respectively; E_{ij}^j is the vague set of the i -th educated laborers in the j -th industry with a significant proportion, and its membership function adopts Gaussian formal function.

That is,

$$E_{ij}^j(y_i) = e^{-((y_i - u_{ij})^2 / \sigma_{ij}^2)}, \quad (i, j = 1, 2, 3, 4). \quad (2)$$

f_j represents the per capita output value of the corresponding industry; f_j is a single-valued fuzzy set, and formula (1) represents the fuzzy system model of the first industry with the education level of workers as input and output per capita as output [13].

Let $f = g(y)$, $y \in R^5$, $f \in R$ be a Gaussian fuzzy logic system, and $\{y_j, f_j\}$, $y_j \in R^5$, $f_j \in R$, ($j = 1, 2, \dots, n$). And y_j is different from each other; then, there is a fuzzy logic system with the number of rules n so that

$$f = g(y), \quad y \in R^5, f \in R, j = 1, 2, 3, \dots, n. \quad (3)$$

The theorem states that as long as N fuzzy rules can be accurately implemented, the input-output mapping relationship of N samples is determined $\{y_j, f_j\}$, ($j = 1, 2, \dots, n$). However, the key to realize this mapping is to determine the membership function in the fuzzy logic system, that is, the central value u_{ij} and standard deviation σ_{ij}^2 , $i, j = 1, 2, 3, 4$, and the parameter f_j , $j = 1, 2, 3, \dots, n$.

4. Realization of Fuzzy System

According to the back propagation learning algorithm of the fuzzy logic system [14], the fuzzy logic system represented by equations (1) and (2) can be represented by the following three-layer feedforward neural network.

4.1. Network Structure. For the above fuzzy system, it is represented by the forward neural network shown in Figure 1.

This network is composed of 4 layers, of which the first layer is the input layer, and the neurons in this layer are divided into N groups (N is the number of rules or samples),

and each group of n neurons composes a fuzzy rule antecedent, and the activation function of the neuron is

$$G(y_i) = e^{-((y_i - u_{ij})^2 / \sigma_{ij}^2)}, \quad i = 1, 2, \dots, n, j = 1, 2, \dots, N. \quad (4)$$

The next layer is the first hidden layer, there are N neurons in total, and each neuron is only associated with its corresponding fuzzy rule [15]. The neuron connection of the antecedent part of the connection weight is 1, and its function is to calculate the fitness of the fuzzy rule, that is,

$$H = E(y_1) \cup E(y_2) \cup E(y_3) \dots \cup E(y_n). \quad (5)$$

The following layer is the second hidden layer, with only two neurons, denoted as I_1 and I_2 , respectively. The connection weights of neuron I_1 and each neuron in previous layer are f_j , $j = 1, 2, 3, \dots, n$, and the connection weight of neuron I_2 and each neuron in the previous layer is 1, and there are

$$I_1: I_1 = \lim_{N \rightarrow \infty} \sum_{j=1}^N f_j H_j, \quad (6)$$

$$I_2: I_2 = \lim_{N \rightarrow \infty} \sum_{j=1}^N H_j.$$

The last layer is the output layer of the network. Its connection weight coefficient with the previous layer neurons is 1, and its output is

$$f = g(y) = \frac{I_1}{I_2} = \lim_{N \rightarrow \infty} \frac{\sum_{j=1}^N f_j H_j}{\sum_{j=1}^N H_j}. \quad (7)$$

4.2. Network Learning. Suppose $\{y_j, f_j\}$, ($j = 1, 2, \dots, n$) is a set of input and output patterns from a Gaussian fuzzy system, the following uses the backpropagation (BP) learning algorithm to determine the fuzzy logic system; that is, the BP algorithm is used to determine the network weight f_j ($j = 1, 2, 3, \dots, n$) and the system parameters u_{ij} , σ_{ij}^2 ($i = 1, 2, \dots, n, j = 1, 2, \dots, N$) [16] so that

$$\sigma_j^2 = \lim_{N \rightarrow \infty} \sum_{j=1}^N [g(y_j) - y_j]^2, \quad (8)$$

which is the smallest.

The learning process is shown in Figure 2.

- (1) The network parameters and f_j , u_{ij} , and σ_{ij}^2 , $i = 1, 2, \dots, n, j = 1, 2, \dots, N$ are given initial values.
- (2) For a given input $y \in R^n$, calculate the parameters H and I_1 and I_2 of the network (i.e., fuzzy system) forward [17].

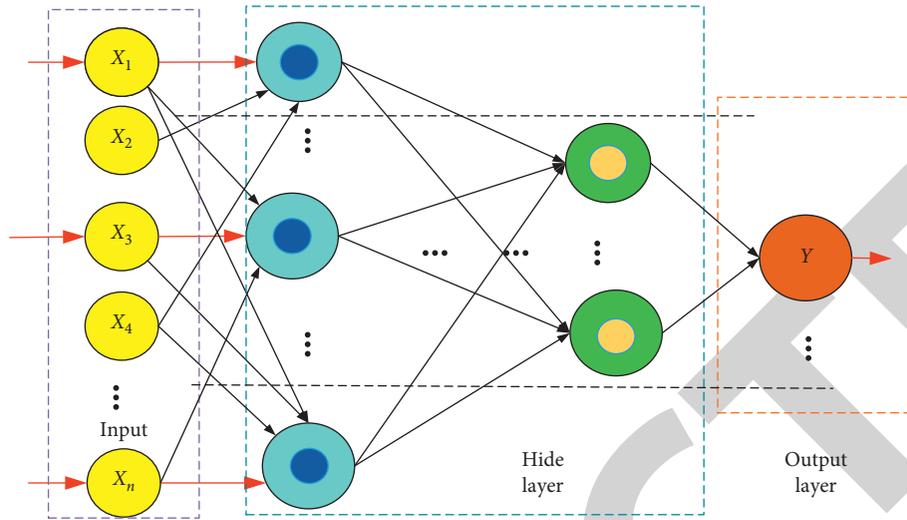


FIGURE 1: Fuzzy model of neural network.

- (3) *Network Parameter Adjustment.* The error back propagation first adjusts $f_j (j = 1, 2, \dots, n)$ as follows:

$$f_j(m+1) = f_j(m) - I \frac{\partial \sigma}{\partial f_j}(m). \quad (9)$$

In the formula, I is a certain step size; $j = 1, 2, \dots, n$; and $m = 1, 2, \dots, n$.

Since $f' = g(y) = I_1/I_2 = \sum_{j=1}^N f_j H_j / \sum_{j=1}^N H_j$, according to the chain guide rule, we can get

$$f_j(m+1) = f_j(m) - I \frac{g-f}{I_2} H, \quad (10)$$

where $j = 1, 2, \dots, n$; $m = 1, 2, \dots, n$.

5. Empirical Analysis of the Evaluation of the Contribution of Education Economy

Economy and education are the two cornerstones of the development of modern society. Looking back at history, no era has paid so much attention to the relationship between education and economy as modern society, and no era has such a close relationship between education and economic development as modern society. The development of modern society directly depends on the progress of science and technology, and the progress of modern science and technology directly depends on the development of education. Modern education achieves its own economic function by penetrating all aspects of scientific and technological progress. The so-called penetration includes promoting the increase in knowledge and technology content in productivity and the acceleration of the update rate, as well as the popularization and application of scientific and technological achievements, and transforming potential science and technology into the actual productivity

eventually leads to the increasing integration of education, economy, and science and technology in modern society into integration [16]. Research on the contribution of education to economic growth is to reveal the closeness of education and modern economic development through the establishment of mathematical models, compare the different positions of education and other production factors in promoting economic development, and provide the most optimized investment decision for economic development, as well as a basis for education decision-making departments to formulate education development plans.

5.1. The Effect of Education on Economic Growth. The contribution of education to economic growth is mainly realized through educating people. Because the economic development of a country is mainly controlled by the level of development of productivity, the most active factor in productivity is people. The quality of the labor force cultivated by a country directly affects the level of productivity and economic development of the country. Therefore, one of the basic economic functions of education is mainly embodied in the cultivation of the quality of laborers participating in social and economic activities. There are many aspects to the cultivation of the quality of workers by education. Some of these qualities directly affect the development of the economy, such as the various knowledge and skills required for modern production, and some indirectly affect the development of the economy, such as moral quality, cultural literacy, political consciousness, and so on. These qualities are necessary for modern production; that is, from a certain perspective, modern production must depend on the development of education. Singh and Dwivedi [17] divided the benefits of education into intrinsic benefits and spillover benefits. Prado et al. [18] also referred to the intrinsic benefits of education as the intrinsic function of human capital. Both intrinsic benefits and spillover benefits

refer to improving the labor productivity (rate) of the educated. As the decision makers of whether to receive education—students and their parents—what they buy is the intrinsic benefits of education. People are educated to obtain intrinsic benefits, while spillover benefits are unexpected things that do not belong to the educated themselves. Another basic economic function of education is that education can provide productivity in the form of scientific knowledge for the material production process of society. Science and technology are the primary productive forces. Once science and technology penetrate into the various elements of productivity, it will be transformed into huge actual productivity and promote economic development. Education not only serves the country's economic development by cultivating qualified workers for a country but also promotes economic development by cultivating senior researchers to provide society with new science and technology.

In the second half of the 20th century, the driving force of world economic growth mainly came from technology and education. In the early post-World War II, economic growth was at the same level as capital accumulation and technological innovation; Japan achieved great success; in the latter part of the Second World War, economic growth evolved into a technological innovation-led type. The United States pays attention to the development of network talents and technology and has achieved great success. The technology and education of the United Kingdom are out of touch with the economy, which has weakened the leading role of economic growth, and economic growth has been slow. This fully reveals that the economic growth model has undergone essential changes and heralds the arrival of the era of knowledge economy.

The growth of the national economy is undoubtedly based on the four wheels of labor, natural resources, capital, and technology [19–23]. These four wheels can be roughly divided into factor inputs, including inputs of means of production, inputs of labor, and inputs of science and technology, as well as factors. Productivity includes labor productivity, capital output rate, and consumption rate of production materials. Among the abovementioned factors, the input of science and technology, factor productivity, and education is closely related [24–27]. Therefore, the effect of education on economic growth can be summarized into the following aspects.

First, education can affect the number and structure of the population, improve the quality of the population, regulate labor behavior, increase labor's scientific and technological knowledge, and improve labor's technical proficiency and management capabilities, thereby increasing labor productivity and promoting economic growth. The two basic elements of social expansion of reproduction are labor and the means of production, of which labor is the primary decisive factor and the main body of production. A worker is a person who has certain production experience and skills or, in other words, a person who has the ability to work. The ability to work is the sum of the physical and intellectual abilities that exist in the human body, that is, the living human body, and are used in the production of a certain use value. With the

development of social productive forces, the requirements for labor ability of laborers are also different, so the education level required for labor reproduction will also be different. However, in any mode of production, a certain amount of education is an indispensable means of labor reproduction, and it is also the main way of labor reproduction. The role of educational production and labor capacity is manifested in three aspects as follows: (1) The production, development, and improvement of human labor capacity which are mainly obtained through acquired education and training activities. (2) Education has a comprehensive impact on people's physical and intellectual abilities. In particular, school education has a comprehensive impact on the educated and provides comprehensive education so that the future labor force and the on-the-job labor force are both physically and intellectually developed. (3) Education is also highly efficient in the production and development of human labor capacity. Education can teach the educated the long-term accumulated scientific knowledge and production technology through purposeful selection, refinement, and generalization. It can be mastered and used in a short time.

Second, education has a huge role in promoting the progress of science. The science referred to in this article includes both soft science (management science, economic system, policy system, and so on) and hard science (production technology, production technology, improvement of production equipment, and so on). Education is an important means and way of scientific and technological progress. The development includes the following. (1) Science can continuously improve laborers' scientific and technological level and production labor skills to promote the application of science and technology in production. (2) Education can promote the development of science and technology and create new productivity. This is because educational institutions, especially higher education institutions, are often scientific research institutions. (3) Education contributes to the promotion and diffusion of science and technology. Technology is a kind of potential productivity; before it is used to be transformed into actual productivity, it must pass through this link of diffusion.

Third, education is conducive to the rational development and utilization of natural resources and the realization of sustainable social development. Education in the integration, development, and utilization of natural resources is manifested in the following three aspects. (1) Educational development can help people better understand natural resources, expand the scope of human practice, and promote the level of human transformation of nature, thereby promoting the economy diversification of development. (2) The development of education helps to reduce the expenditure of natural resources and improve the efficiency of resource utilization. (3) Educational development contributes to the protection of natural resources and the environment [28, 29]. Through education, people's awareness of environmental protection is raised, and people are encouraged to consciously participate in environmental protection activities and achieve sustainable economic development.

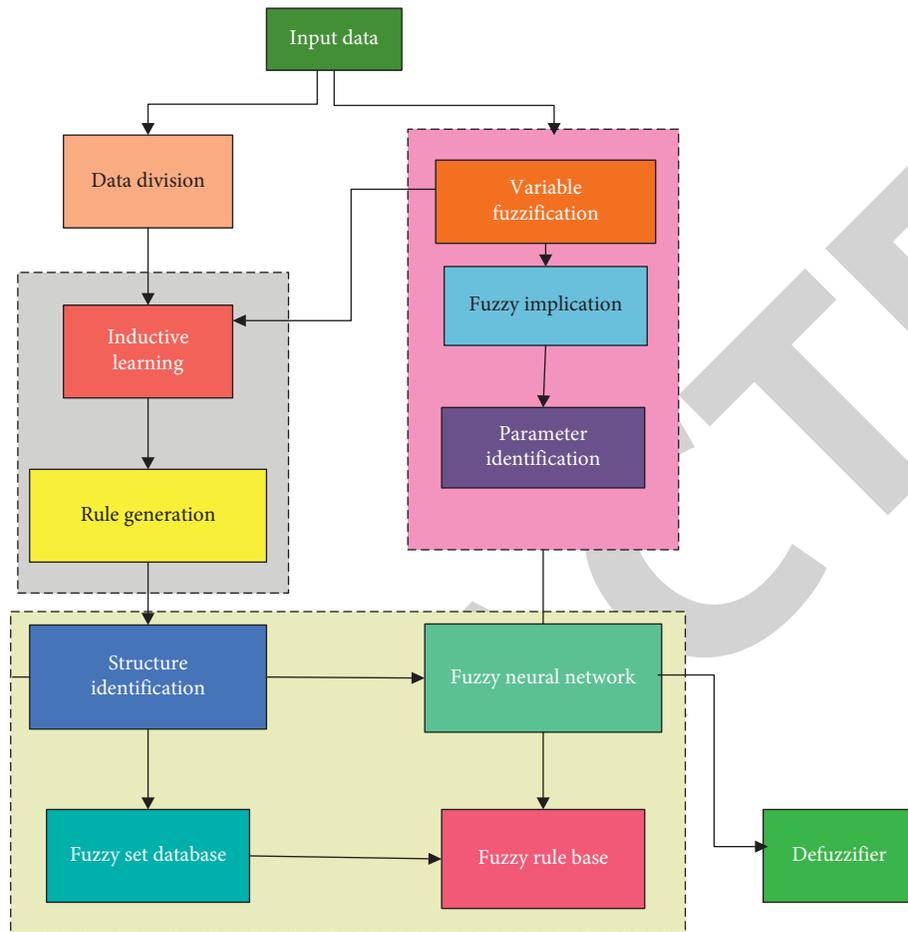


FIGURE 2: Implementation steps of the fuzzy system.

5.2. Sample Selection Criteria. Higher education is a variety of professional education based on secondary education divided into college, undergraduate, and postgraduate education. Higher education is responsible for the dual tasks of cultivating various specialized talents and conducting scientific research. Higher education institutions generally include general higher education institutions, adult higher education institutions, and private higher education institutions.

For reasons such as the main status of ordinary colleges and universities in higher education and the reliability of data, this article selects various data from ordinary colleges and universities when selecting samples. At the same time, to measure the scale of higher education development in a country and region, there is a complete indicator system, which mainly includes the demographic, social, and economic background of the development of higher education; the financial and human resources invested in higher education; and the social population's opportunities to receive higher education. The factors considered include the learning environment and organizational management of colleges and universities, the teaching order and student

performance of colleges and universities, the number of schools in colleges and universities, the number of enrollments and the number of students, the social output of higher education, and the output of the labor market. Each aspect contains several specific indicators. This article selects the most important and intuitive four indicators when selecting a sample of the scale of higher education development such as the number of ordinary colleges and universities, the number of enrolled students in ordinary colleges and universities, and the number of ordinary colleges and universities. When selecting economic growth indicators, this study selected a typical indicator of gross domestic product. The education level of workers in 2019 and the corresponding per capita output value of workers are shown in Figure 3.

In the correlation equations of 1.0 and 1.5, let $N=4$ and $n=5$ and the step size $I=0.01$. After the network runs for 2000 steps, the system error meets the requirements.

5.3. Collection and Arrangement of Data. This study selected four main indicators for the development of higher education

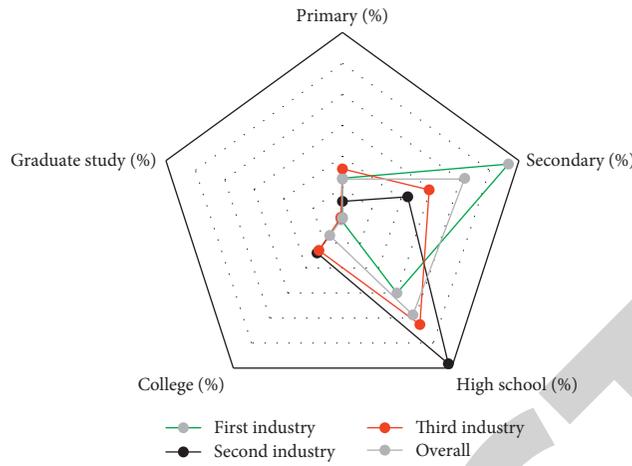


FIGURE 3: Original data table.

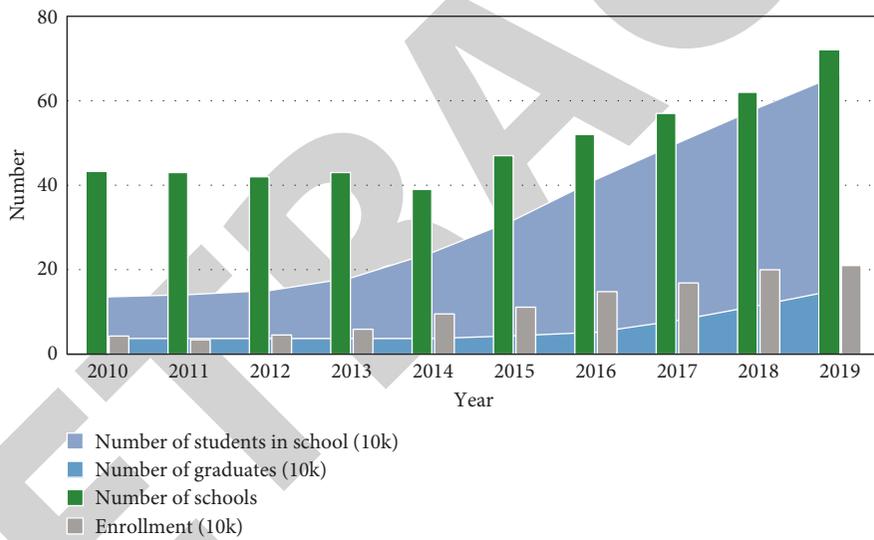


FIGURE 4: The main indicators of higher education in Province A from 2010 to 2019.

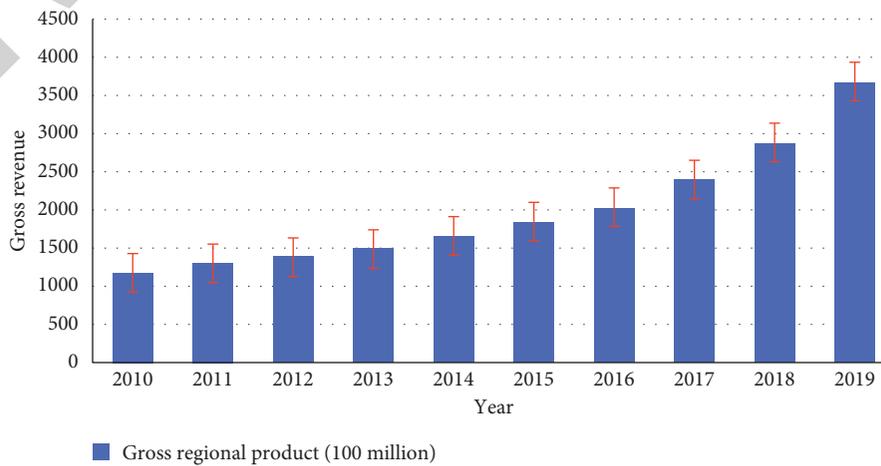


FIGURE 5: 2010–2019 GDP of Province A.

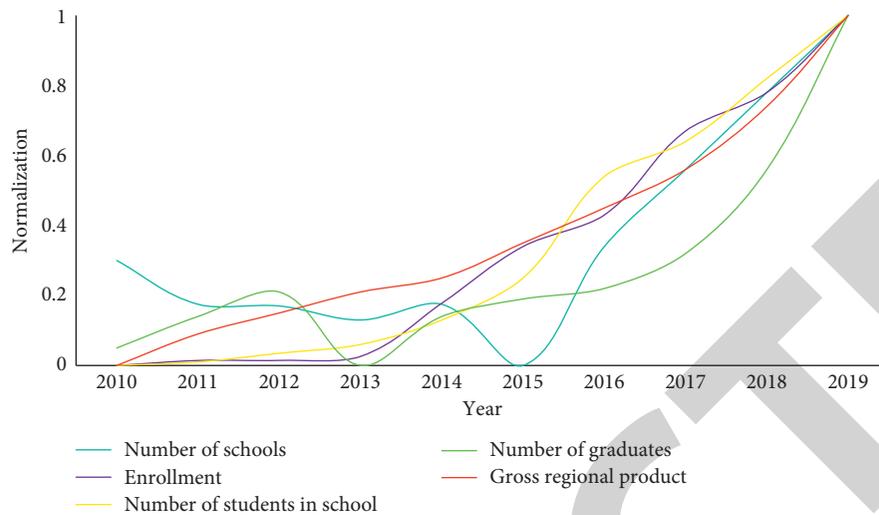


FIGURE 6: Input and output values after “normalization” processing in Province A.

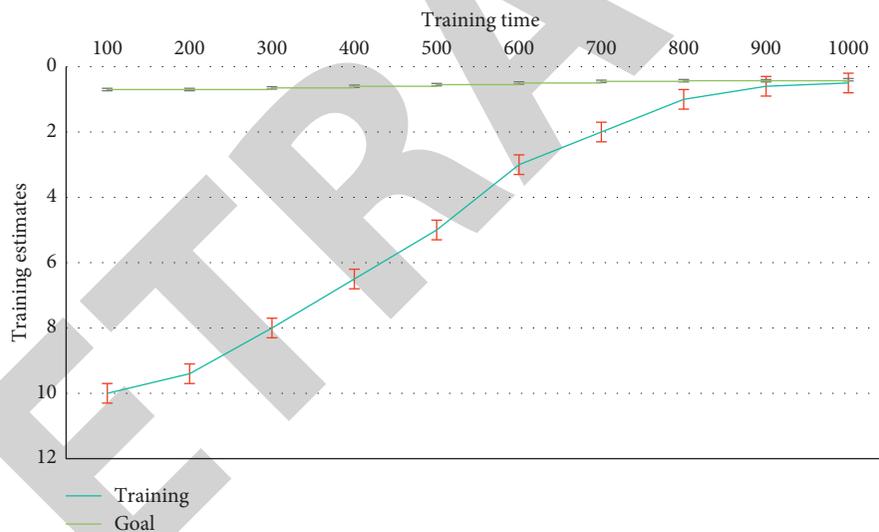


FIGURE 7: The training process of the sample neural network system in Province A.

in Province A from 2010 to 2019: the number of ordinary colleges and universities, the number of enrolled students in ordinary colleges and universities, the number of students in ordinary colleges and universities, and the number of graduates from ordinary colleges and universities (see Figure 4) as the input value of the BP neural network. The main indicator of economic growth is selected: regional GDP (as shown in Figure 5), as the output value of the fuzzy neural network model. It analyzes the relationship between the scale of higher education development and economic growth by studying the effects and influence of the four main indicators of higher education in Province A on the local GDP.

The original data are normalized. The following formula for a total of five columns of input and output data is executed.

The processed data are all between 0 and 1, which are conducive to the training and application of fuzzy neural networks. For the processed data, see Figures 5 and 6.

Research results show that higher education is playing an increasingly important role in economic and social development, but economic growth and the scale of higher education development are not always positively correlated with a linear relationship. During the execution of the program, the part of manual intervention is only the input of

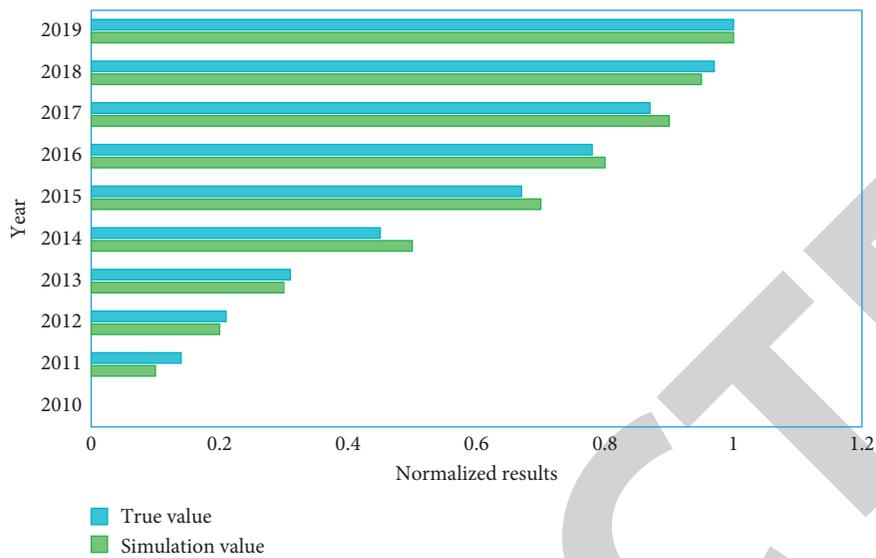


FIGURE 8: Comparison of simulated values and actual values of samples in Province A.

the number of neurons in the hidden layer of the neural network. The training process of the BP neural network is shown in Figure 7. From the training process, the network converges quickly. After 1200 times of network training, that is, the defined target error is within 0.0001 and the execution process is good, which proves that there is indeed an objective law between the input value (the main indicator of higher education in Province A) and the output value (the GDP of Province A).

The comparison between the simulated value of the network sample and the actual regional GDP is shown in Figure 8. It can be seen that the simulation result of the network and the actual value is completely within the expected error range, which proves that the training process of the network is good, and the trained network can be used for application analysis.

According to the analysis of the output of the program, when the number of ordinary colleges and universities increases by one, the regional GDP will decrease by 4.12 billion yuan, and the regional GDP will increase by 2.14 billion yuan (including the merger of colleges and universities). For every 10,000 increase in the enrollment of ordinary colleges and universities, the regional GDP will decrease by 1.21 billion yuan, and for every 10,000 reduction, the regional GDP will increase by 1.24 billion yuan. For every 10,000 increase in the number of people, the regional GDP will decrease by 5.12 billion yuan, and for every 10,000 decrease, the regional GDP will increase by 5.42 billion yuan; for every 10,000 increase in the number of graduates from ordinary colleges and universities, the regional GDP will decrease. The value will increase by 17.42 billion yuan, and for every 10,000 reduction, the regional GDP will decrease by 7.62 billion yuan.

From the results of the above procedures, it can be seen that from 2010 to 2019, there is a positive correlation between the scale of higher education development and

economic growth in Province A. Since this procedure uses the higher education indicators of this year to analyze the regional GDP this year, the long-term benefits of higher education on economic growth are not considered. Only in the short term, the scale of higher education development and the economy have continued to grow. There is a linear relationship between growth. The main factors affecting economic growth include capital, labor, natural resources, technology, and education. It can be seen that higher education is not the only factor affecting regional GDP. This procedure is only to study the impact of higher education in Province A on the regional GDP of the year and is based on the fact that other factors have not changed.

6. Conclusion

This paper studies and demonstrates the correlation between economic growth and the scale of higher education development. On the basis of relevant domestic and foreign theories and policies, a regression analysis of the balance of higher education development and economic growth was conducted. The data measure the nonlinear relationship between the scale of higher education development and economic growth. This research analyzes the status of higher education in economic and social development, the effect of higher education on economic growth, and the effect of economic growth on higher education. On this basis, it puts forward the relationship between economic growth and the scale of higher education development. The new thinking analyzes the positive correlation between economic growth and the scale of higher education development from a theoretical perspective. It can be seen from the results of the program that there is a positive correlation between the scale of higher education and economic growth.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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References

- [1] X. Lin, S. Zeng, and X. Li, “Online correction predictive energy management strategy using the Q-learning based swarm optimization with fuzzy neural network,” *Energy*, vol. 223, Article ID 120071, 2021.
- [2] V. Glinskiy, L. Serga, M. Khvan, and K. Zaykov, “Fuzzy neural networks in the assessment of environmental safety,” *Procedia CIRP*, vol. 40, pp. 614–618, 2016.
- [3] R. J. Kuo, Y. S. Tseng, and Z.-Y. Chen, “Integration of fuzzy neural network and artificial immune system-based back-propagation neural network for sales forecasting using qualitative and quantitative data,” *Journal of Intelligent Manufacturing*, vol. 27, no. 6, pp. 1191–1207, 2016.
- [4] P. Jiang, H. Yang, and J. Heng, “A hybrid forecasting system based on fuzzy time series and multi-objective optimization for wind speed forecasting,” *Applied Energy*, vol. 235, pp. 786–801, 2019.
- [5] F. García, F. Guijarro, J. Oliver, and R. Tamošiūnienė, “Hybrid fuzzy neural network to predict price direction in the german DAX-30 index,” *Technological and Economic Development of Economy*, vol. 24, no. 6, pp. 2161–2178, 2018.
- [6] Y. Huang, L. Jin, H.-s. Zhao, and X.-y. Huang, “Fuzzy neural network and LLE algorithm for forecasting precipitation in tropical cyclones: comparisons with interpolation method by ECMWF and stepwise regression method,” *Natural Hazards*, vol. 91, no. 1, pp. 201–220, 2018.
- [7] Y. Xia, M. H. Hung, and R. Hu, “Performance prediction of air-conditioning systems based on fuzzy neural network,” *Journal of Computers*, vol. 29, no. 2, pp. 7–20, 2018.
- [8] R. Efendi, N. Arbaiy, and M. M. Deris, “A new procedure in stock market forecasting based on fuzzy random auto-regression time series model,” *Information Sciences*, vol. 441, no. 2, pp. 113–132, 2018.
- [9] H. Liang, J. Zou, Z. Li, M. J. Khan, and Y. Lu, “Dynamic evaluation of drilling leakage risk based on fuzzy theory and PSO-SVR algorithm,” *Future Generation Computer Systems*, vol. 95, pp. 454–466, 2019.
- [10] Q. Tu and Q. Zhang, “Evaluation of seawater quality in Hangzhou bay based on TS fuzzy neural network,” *Journal of Coastal Research*, vol. 94, no. 1, pp. 50–54, 2019.
- [11] J. Wang, H. Li, and H. Lu, “Application of a novel early warning system based on fuzzy time series in urban air quality forecasting in China,” *Applied Soft Computing*, vol. 71, pp. 783–799, 2018.
- [12] S. S. Lin, S. L. Shen, A. Zhou, and Y. S. Xu, “Risk assessment and management of excavation system based on fuzzy set theory and machine learning methods,” *Automation in Construction*, vol. 12, no. 2, Article ID 103490, 2021.
- [13] H. Li, “Research on prediction of traffic flow based on dynamic fuzzy neural networks,” *Neural Computing and Applications*, vol. 27, no. 7, pp. 1969–1980, 2016.
- [14] G. Sideratos, A. Ikonopoulou, and N. D. Hatziargyriou, “A novel fuzzy-based ensemble model for load forecasting using hybrid deep neural networks,” *Electric Power Systems Research*, vol. 178, Article ID 106025, 2020.
- [15] M. Rafiei, T. Niknam, J. Aghaei, M. Shafie-Khah, and J. P. S. Catalão, “Probabilistic load forecasting using an improved wavelet neural network trained by generalized extreme learning machine,” *IEEE Transactions on Smart Grid*, vol. 9, no. 6, pp. 6961–6971, 2018.
- [16] X. Tang, Y. Dai, T. Wang, and Y. Chen, “Short-term power load forecasting based on multi-layer bidirectional recurrent neural network,” *IET Generation, Transmission, and Distribution*, vol. 13, no. 17, pp. 3847–3854, 2019.
- [17] P. Singh and P. Dwivedi, “Integration of new evolutionary approach with artificial neural network for solving short term load forecast problem,” *Applied Energy*, vol. 217, pp. 537–549, 2018.
- [18] F. Prado, M. C. Minutolo, and W. Kristjanpoller, “Forecasting based on an ensemble autoregressive moving average-adaptive neuro-fuzzy inference system–neural network-genetic algorithm framework,” *Energy*, vol. 197, Article ID 117159, 2020.
- [19] H. Z. Wang, G. Q. Li, G. B. Wang et al., “Deep learning based ensemble approach for probabilistic wind power forecasting,” *Applied Energy*, vol. 188, pp. 56–70, 2018.
- [20] A. Junio Guimarães, P. Vitor de Campos Souza, V. Jonathan Silva Araújo, T. Silva Rezende, and V. Souza Araújo, “Pruning fuzzy neural network applied to the construction of expert systems to aid in the diagnosis of the treatment of cryotherapy and immunotherapy,” *Big Data and Cognitive Computing*, vol. 3, no. 2, p. 22, 2018.
- [21] E. Zamirpour and M. Mosleh, “A biological brain-inspired fuzzy neural network: fuzzy emotional neural network,” *Biologically Inspired Cognitive Architectures*, vol. 26, pp. 80–90, 2018.
- [22] J.-F. Qiao, Y. Hou, L. Zhang, and H.-G. Han, “Adaptive fuzzy neural network control of wastewater treatment process with multiobjective operation,” *Neurocomputing*, vol. 275, pp. 383–393, 2018.
- [23] M. Chen, S. Lu, and Q. Liu, “Uniqueness of weak solutions to a keller-segel-navier-stokes system,” *Applied Mathematics Letters*, vol. 121, Article ID 107417, 2021.
- [24] Y. Lv, Y. Liu, W. Jing et al., “Quality control of the continuous hot pressing process of medium density fiberboard using fuzzy failure mode and effects analysis,” *Applied Sciences*, vol. 10, no. 13, p. 4627, 2020.
- [25] Q. Ke, J. Zhang, W. Wei et al., “A neuro-heuristic approach for recognition of lung diseases from X-ray images,” *Expert Systems with Applications*, vol. 126, pp. 218–232, 2019.
- [26] J. Zhang and C. Shen, “Set-based obfuscation for strong PUFs against machine learning attacks,” *IEEE Transactions on Circuits and Systems I: Regular Papers*, vol. 68, 2020.
- [27] B. Wang and L. L. Chen, “New results on the control for a kind of uncertain chaotic systems based on fuzzy logic,” *Complexity*, vol. 2019, Article ID 8789438, 8 pages, 2019.
- [28] J. J. Chen and M. F. Liu, “Does the Internet expand the educational gap among different social classes: the protective

- role of future orientation,” *Frontiers in Psychology*, vol. 12, p. 1255, 2021.
- [29] K. Sim, J. Yang, W. Lu, and X. Gao, “Blind stereoscopic image quality evaluator based on binocular semantic and quality channels,” *IEEE Transactions on Multimedia*, p. 1, 2021.

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