Sensitivity Analysis based on Artificial Neural Networks for Evaluating Economical Plans

Fraydoon Rahnamy Roodposti, Reza Ehtesham Rasi

***Abstract*—the present article offers a learning method under supervision of artificial neural network based on sensitivity analysis and uses from Perception learning algorithm. In this article we attempt to evaluate sensitivity of variables (interest rate, depreciation, tax, inflation, foreign currency rate, salary, wage and market demand) in basic year in comparison to next year by using artificial neural network. Results of present research indicate that interest rate, tax and inflation in next year in comparison to basic year has very high sensitivity and management shall have attention and try to control it, on the other hand by increasing numbers of learning a neural network the model will be improved so that at 5th stage of learning, average squares of learning error will be lowest and regression will be one.**

Key Words: **Artificial Neural Network, Evaluating Economical Plans, Making Decision, Sensitivity Analysis.**

I. Introduction

In nowadays hectic and uncertain world having attention to uncertainty of future events and inexactness of information in relation to selecting optimum plan and necessity of economical analysis of industrial plans is very important. Economical analysis of projects depends on uncertain events in future and unclear and inexact information. Thus measuring income and costs of an industrial plan mainly is accompanied with possibilities that problem of possibilities maybe either mentioned or not mentioned in project. Therefore sensitivity analysis a form of trade economical analysis in future that is used at economical studies and sometimes it is used instead of ordinary risk analysis. Anyway sensitivity analysis and its different forms are very investor that is there any way for selecting most suitable plan or economical project? Sensitivity analysis as final important step in making decision for selecting best optimum project plays considerable role and if a small change in a parameter will result in considerable change in results, it is able to apply required sensitivity. Whereas manual methods that are under control of complete certainty conditions rarely occur at present environment thus recognizing new techniques based on mathematical and computer sciences seems necessary. In the present research in order to anticipate, training and learning it is used from neural networks. Artificial neural networks are able to learn complicated functions that executing them by systems based on rule is very difficult. Most of the studies that are performed today, seek to find mixed systems in which neural networks (with ability of learning) will put next to systems based on rule (ability of explanation in relation to what they do). When 2 systems will be able to work next together then we will have expert machines. Artificial neural networks in fact are a kind of method for processing information and act as biologic neuron of human. Each of the information (signal) is connected to other neurons via a kind of relationship called weight. Usually weight of first neuron is called bios and its characteristic is that entry of neuron is always one. Main characteristic of artificial neural network is its parallel performance. In fact neural network are responsible for learning in human and fulfill their duties in parallel mode, meanwhile if we want to simulate weight of neurons of human by computer, it will be performed in series or continuous mode. The present article deals with sensitivity analysis based on artificial neural network for selecting economical plan and uses from initial basics of sensitivity analysis and artificial neural network. Sensitivity analysis is a kind of revision about evaluating economical plan and uses from artificial neural networks for implementing complicated functions in different fields including discriminating pattern, classification, learning and control systems in sensitivity analysis model. This article is consist of 6 sections that first section deals with introduction, second section deals with theoretical basics and research literature, third section deals with methodology and hypothesis of research, forth section deals with theoretical model of research (sensitivity analysis and artificial neural network), fifth section deals with test for model of sensitivity analysis by using artificial neural network and sixth section deals with conclusion. The aim of present research is sensitivity analysis based on measuring learning rate and anticipation by using artificial neural network and validity of this model.

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II. Theoretical Basics & Research Literature

Nikomaram and coworkers (2006) believe that decision making is the main duty of each manager at any level of economical units and organizations and this issue in profit making units has got more importance. Importance and status of decision making at set of managerial activities is so that Herbert Simon regards science of management as science of decision making. Decision making is a process in which by performing it we can select suitable solution for a problem for set of problems. Decisions including constructing factory, development and entering into foreign markets influences on periodical performance of profit making unit. These decisions are among strategic decisions that are regarded as process of capital budgeting. Decisions of capital budgeting include planning for cost of projects that their life time is minimum more than 1 year. Decisions of capital costs make strategic planning as a necessary issue

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which demands accessing to engineering and marketing information. Hosseini and Amouzegar(2008) believe that investment opportunities means a mode that company, investor or government needs investment that will have specified cash income in future i.e. it is operation that needs investment at present time and return of it in future. Economical evaluation of projects shall be performed in accordance with aims of projects and based on sequence of parameters and regulations. In spite that engineering economy try to solve problem based on quantitative parameters but it shall be observed that in many cases the qualitative regulations influence quantitative regulations. Sometimes political, social and cultural issues that are described as parameters of project have same importance as level of investment and quantitative output of projects. The problem is how to discriminate and observe parameters in projects. Main sections of financial resources are invested on profit making units and non-profit making units in long term projects. Results of these projects will be specified in long term. Therefore factors including interest rate, depreciation, inflation, foreign currency rate, level of income, wage have considerable role on decision making. Nature of such decisions will cause that in order to evaluate interests and costs of investment (sensitivity analysis) to use from common methods of financial mathematics. In this way future interests of long term projects with mode of depreciation or future value of projects will be specified. Output as a result of projects is specified and calculated by using financial mathematics method. Financial mathematics under certainty conditions is able to respond financial problems, meanwhile under uncertainty environment and present risk it is need to use from modern mathematical and computer methods in financial management and especially in the field of engineering economy that can be explained within framework of Investment Engineering. Oskonejad(1989) believes that in fact sensitivity analysis is a kind of revision about economical evaluation and the aim of sensitivity analysis is helping to decision making persons, therefore if initial parameters will change but initial results will not change it will be hopeful for investor and he will have better feeling. Hosseini and Amouzegar(2008) believe that sensitivity analysis will be offered before risk analysis. Under simple mode this analysis deals with return rate changes of project as a result of changing numerical amount of one, two or three main variables. Under this mode possible evaluation is in relation to variables that are close to level of accepting risk and defeat of a project under complicated modes at sensitivity analysis in which it is used from issues of risk analysis so that we will improve possible distribution of variables. In the year 1956 Rockefeller foundation held a conference that its perspective included: using from computers and simulation at any field of learning and other fields of intelligence. In that conference the term Artificial Intelligence (AI) was publically used. In the present article neural networks are regarded as subset of artificial intelligence. Besides genetic algorithms, fuzzy logic or fuzzy systems, wavelets, cell automat and chaos systems are classified as a past from general field of artificial intelligence. An artificial nerve is a model in which its components have direct similarity with real components. Generally artificial intelligence is described as: computerized process in which they attempt to imitate thought of human and these process are related with activities that need to use human intelligence (Ghazanfar and Kazemi 2008, page 503). The aim of artificial intelligence is general modeling of human as a unit entity that this work is performed by a computer model which has behavior similar to brain. Studying structure of brain(that is consist of billions of continuous nerves) and conducting research in relation to performing activities similar to brain is performed by networks of artificial nerves(Ghazanfari and Erkat 2004, page3). Artificial neural networks by using from pattern of brain try to anticipate learning phenomena of nature by using mathematical models in future and show their error. Neural networks are constructed by simple operational elements in parallel mode. These elements inspire from bio neural systems. In nature structure of neural networks are specified by connection among components. Therefore we can construct an artificial structure following up natural networks and by adjusting level of connection for each connection to specify weight of connection and the way of relationship among components. After adjusting or training neural networks, applying a special entry will result in receiving special answer. As it can be seen in figure (1) network will be compatible in accordance with adaptation among entry and aim so that output of a network and aim will be adapted. Mainly most of these input and output couples are used so that they will be called as supervised learning and be given to training network (KIA 2008, page 29). At present time the neural networks that are used include: hetero-associative neural network in which output vector is different with input vector and auto-associative neural network in which input vector and output vector is same. The neural network that is used at present article is hetero-associative neural network.

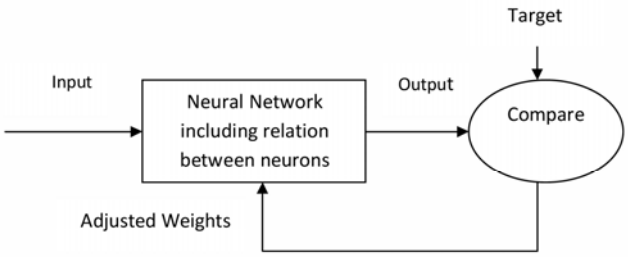

Figure1: Artificial Neural Network

III. Methodology & Hypothesis of Research

The present research is library research with approach of studying theoretical basics that in accordance with assumed data deals with sensitivity analysis based on artificial neural network for economical evaluation of capital project. Some of the questions of this research include:

A- Is it possible that by using artificial neural network to measure sensitivity at economical evaluation of industrial plans?

B- If artificial neural network is able to create ability of learning and required sensitivity of rule when a small change in a parameter will result in considerable change in results?

Innovation of present research is about relationship among engineering economy at section of sensitivity analysis for measuring level of sensitivity, training, learning and anticipating results by using artificial neural network. The

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aim of offering this article is entering to modern topics (artificial neural network) in the field of engineering economy and financial management. Whereas professors and students in the field of financial management and engineering economy in recent years have not attention to modern topics of mathematics and computer sciences at available books, therefore researchers have attempted to enter into new fields of mathematical topics. It shall be mentioned that many experts in the field of financial management believe that one of the factors that aggravated economical crisis in years 2008 and 2009 was negligence for solving problems of investment markets under condition of risk and uncertainty. Most of the management and financial engineering books in recent years did not have attention to modern mathematical topics and have only dealt with models under certainty condition and primitive statistical and possibility models in financial management. The present article offers a hypothesis under title of "Ability of Explaining Sensitivity Analysis Based on Artificial Neural Networks for Economical Evaluation of Investment Projects that can be evaluated".

IV. Theoretical Model of Research

A. Sensitivity Analysis

Hosseini and Amouzegar (2008) believe that sensitivity analysis means testing happenings that are occurred as a result of changing income and costs of a project for return rate or present net value of a project. By having such analysis first method that bears highest effect on net interests of project will be recognized and then changes of these variables and their effects on system will be evaluated. Besides this problem it is possible to achieve ideas and opinions in relation to risk of project. In order to perform analysis we shall be familiar with key concept of transfer value of each variable. The key amount of transfer value for each variable is an amount that as a result of it the present net value will be equal to zero. Sensitivity analysis can be performed by NPW, ROR and NEUA methods by using financial process before tax or after tax. Sensitivity analysis can be studied for each of the involved elements and its results on geometrical graph can be shown as percentage for change of main elements. One of the advantages of geometrical graphs is that they are mixture of information on graph that can be easily understood. All of the questions are started with this question that "what happens if". If decision will have higher risk their checklists of questions will be higher. Therefore we shall observe number of critical and sensitive factors and study result of changing factors.Oskonejad (1989) believe that sensitivity analysis means repeating calculations of a financial process by changing main parameters and comparing its results with results of initial information. Sensitivity analysis has some problems. For example correlation among variables themselves in this system shall be observed (interest rate, inflation, tax). Ordinary technique of sensitivity analysis is to observe changes of a variable under condition that other variables are fixed which means that variables are not correlated with together. In case of having correlation the correlated variables will be changed. It is possible that sensitivity analysis may not introduce any fundamental variable to us, even if several long lists of variables were tested. There are 3 types of using sensitivity analysis in relation to selecting models and testing sensitivity on them that include:

* Group income and costs; in simple sensitivity analysis changes for total sum of costs and incomes of project will be studied. This mode is useful when group effect of variables will be observed together.
* Critical elements of incomes and costs; often sensitivity analysis is used when incomes and costs are mentioned in part and are specified by analyzing critical variables of project.
* Effect of time delay on project; it is possible to mention different delay in project including delay in starting project, delay in operational phase of construction, delay in achieving to producing optimum point at industrial projects.

B. Artificial Neural Network

Human in some problems including creativity, discrimination and learning acts better than computer, thus scientists have always intended that by using advances of biologic, mathematical and computer science to simulate abilities of human by computer. Learning power in human means learning surround patterns by repetition and repeating one of the characteristics of that pattern in thought of human(Mehrjou 2007, page 3). A biologic neuron by gathering its entries via dendrites with a special synaps weight that is applied on neuron and by reaching to a specified limit will produce output. This specified limit is threshold limit and in fact it is factor for activity of neuron or its inactivity. By offering aforesaid explanations it can be said that in a biologic neuron modeling in artificial mode the following three factors shall be attention:

1- Neuron is either active or inactive.
2- Output is only depends on entries of neuron.
3- Entries shall reach to a limit so that output will be created. (Alborzi 2001)

Artificial neural networks that are related to simulating learning power in human and implementing it are in a form of computer algorithms. It is network of related elements that are called neural networks. These elements are inspired from studies that are conducted in the field of neural systems i.e. the aim of neural networks is attempt for constructing machines that act like human brain. These machines are consisted of components that behave similar to biological nerves of human. Ghazanfari and Kazemi have explained an artificial neural network as: A system of processing data that is consisting of many simple processors that are related together (i.e. artificial nerve) and its structure is inspired from shell of brain. The work of a neural network is to create an output pattern based on input pattern that is offered to network. Neural networks have pattern classifier. But each pattern classifier is not neural network. One of the main characteristics of neural networks is ability of learning and extending. Learning means that system learns and recognizes specified patterns and gives them correct output answer. The process of learning can be used in relation to electronic memory, in this way first all of the amounts of memory will be equal to zero and then there will be a phase of learning in which samples of input patterns into memory will be shown and a number 1 is shown from status of memory by these patterns. Generally artificial neural networks have four main characteristics that include:

* They learn via example.

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* They form vast and auto associative memory.
* They neglect faults.
* They are able to discriminate pattern.

Neural network has two main duties that include: Learning and Recall. Learning means process of balancing relation weights in artificial neural network so that network while receiving stimulant vector by input layer will be able to produce desired output vector as answer. Generally learning has two forms including: Supervised Learning, in which artificial neural network is taught to offer desired answer to input stimulant and Unsupervised Learning in which we do not want to have special answer, rather answer depends on ability of network for organizing itself and only input variables will be applied on input layer of network. Supervised learning has vast application in engineering. Under this mode a stimulant enters into input layer and a stimulant will be offered to output layer which indicates suitable answer to that special input. This suitable answer shall be specified by an informed and expert teacher and a kind of difference will be created among answer of real network and suitable answer to an error in which it is used from this error for balancing relation weights. In other cases including competitive learning or Heb learning, balancing weights is performed based on criterion in which nature specifies its process of learning. Recall is process of entering a stimulant and production of an output answer based on weight structure of network. In the process of recall a neural network enters into stimulant and accepts a layer and in the output layer it produces an answer that this answer is specified by process of learning. (Ghazanfari and Kazemi 2008, page 518-519) After Dortmund conference, Frank Rouzenbelt from Kernel flight laboratory created a calculation model called Perceptron for eye retina. Perceptron model was formed by inspiring from Mack Kalous- Petez model and continuous learning of Heb and includes when input and output synaps of a nerve will be active the strength of communications will be increased. Perceptron rule of learning will be repeated and achieve its weights via repetition method and network is educated via linear classes i.e. it is divergent for XOR patterns of network (algorithm in a loop is infinite) and it can not achieve any weights. At first weights will achieve random amounts but simply they can be observed as zero.

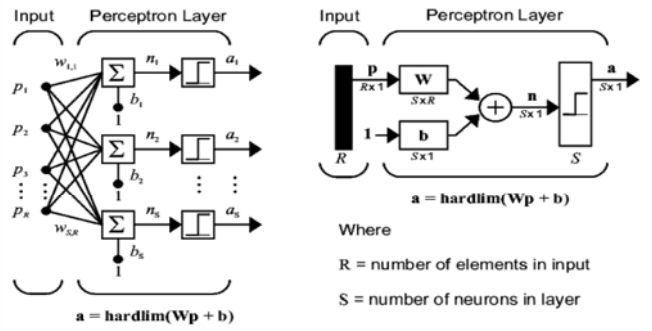

Figure 2: Feed Forward Single Layer Neural Network

There is special kind of multi layer neural networks that is called Single layer Perceptron (SLP). This network is consisting of input and output layer. Perceptron is a pattern classifier system that can discriminate desired patterns and geometrical patterns. The first Perceptron was a visual system and its retina has 400 photocells that were connected to linking input units. This entrance layer collected photocell electrical pulses. Photocell randomly connected to lining units and received some stimulants. Output of sensor is connected to a set of telecommunications that is pre-specified by processor elements (they are called demon) which discriminated differ type of patterns. In many of the complicated mathematical problems that deal with solving difficult non-linear equations, it is possible to use from a multi-layer network of Perceptron by simply offering explanation in relation to weights and suitable functions. Functions are used for different cases in accordance with their neurons. In this kind of network an input layer for applying input of problem, a hidden layer and an output layer that offers answer of problem is available. Knots that are in input layer are sensory neurons and knots of output layer are responding layers. In hidden layer there are some other hidden neurons as well (Haeri and coworkers 2000). Rouzenbelt has studied 2 layers and 3 layers Perceptron. He has proved that 2 layers Perceptron can divide input into 2 classes provided that these classes will be separate from view point of linear. In some systems it is used from supervised learning in which weights are balanced in appropriate with suitable output and real output. Approach of Perceptron is first designed for explanation and modeling vision system for discriminating pattern. Perceptron was feed forward network in which it did not have any feedback and there was no link among same layer nerves and there was no random action in network. Training these networks is usually performed with back propagation method. A sample of a Perceptron network is shown here.

Multi-layer Perception network can be used with any number of layers but the theorem that we here accept with proving is that a 3 layers Perception network is able to separate any kind of space. This theorem is called as Kolmogrov Theorem indicates a very important concept that it can be used at constructing neural networks (Alborzi 2001).

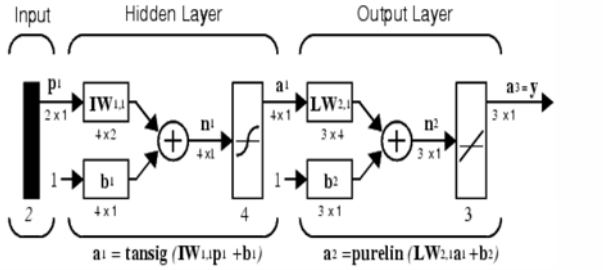

Figure3- Structure of Multi-Layer Perception with Hidden Neurons Tansig and Output Neurons with Linear Function

Ghazanfari and Kazemi (2008) have described learning pattern of Perceptron as following:

* If output is correct, weights will not change.
* If output will be 1 but at present time it will be 0, the weights on lines of active input will be increased.
* If output will be 0 but at present time it will be 1, the weights on lines of active input will be decreased.

Amount of changing weights depends on method of learning. In Perceptron there are three types of learning that including:

* Fixed decrease or increase.

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* Decrease or increase that depends on error will change (error means difference among sum of weights and suitable output).
* Mixture of fixed increase and increase compatible with level of error.

Since Rouzenblet introduced Perceptron, several version of it were offered that include:

1- Eliminating limitation of 0 or 1(binary) for input so that input will be able to be any real number.

2- Applying learning coefficient including η the same as odd line.

Perceptron will be trained in accordance with a series of requested behaviors. Suitable behaviors can be summarized via input and output couples.

P1t1, p2t2… pqtq

In which p is input of network and t is correspondent target of p. The target of decreasing error or e is that it will be equal to t-a. (a is output of network and t is target) The rule for learning Perceptron calculates suitable change for weights and bias of Perceptron by using entrance p and error e. when learnp will be executed the Perceptron will have higher opportunity for producing suitable output. Perceptron rules result in convergent of network at infinite number. One of the reasons for importance of Perceptron is developing an artificial neural network that is convergent theory of Perceptron which means that if it is possible to execute a problem on Perceptron the learning rule for limited stages will have one solution. Another design that was accompanied with Perceptron included A) Dividing a piece of picture into smaller pieces, B) Creating neural networks that is for special regions.

V. Sensitivity Analysis Test by using Artificial Neural Network

In order to study different problems of sensitivity analysis, we assume that an industrial company x is launching a new production line and anticipates that in the next year it will be faced with following changes:

Table 1: Showing Sensitivity Analysis

Variables of Sensitivity Analysis	Numbers in Basic Year	Numbers in Future Year
Interest Rate	0.10	0.15
Depreciation	2	3
Tax	0.25	0.25
Inflation	0.14	0.155
Foreign Currency Rate	1000	1050
Salary & Wage	82	90
Demand	60	63

After recognizing variable of sensitivity analysis, single layer artificial neural network of Perceptron is shown in figure 4. In neural network as it can be seen there is single layer, one input and output, 20 hidden layers and 50 neurons.

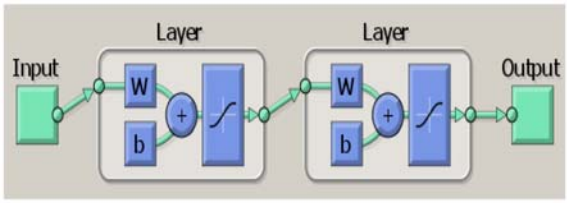

Figure 4- Showing Single Layer Artificial Neural Network at Sensitivity Analysis Model

Data of sensitivity analysis for specifying training and learning neural network can be executed via Matlab software. This model in first stage has 8 iteration and 1000 epochs. During 0:00:17 at first stage intends to learning and training and this very short time due to simplicity and single layer will be entered into network. Gradient for model is 1.66 and its validity is numerical value of 6 and on the other hand learning power is 0.05 for Perceptron neural network that is assumed by researchers. In figure 5 status of training is completely shown. As it is obvious the factors of interest rate, depreciation, inflation have high sensitivity and aforesaid figure indicates that numbers of next year have growing process and management of company shall have higher attention and try to control it. Factors including tax, foreign currency rate, salary and wage and demand have partially fixed slope and by passing time and increase rate they will not go under severe change and fluctuation.

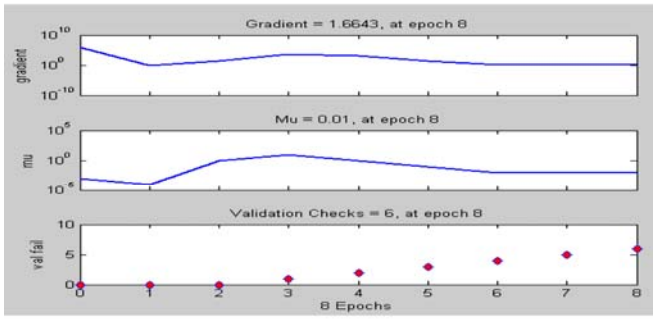

Figure 5: Status of Learning

In figure 6 in order to assess validity of aforesaid model that is trained by neural network, regression of sensitivity model at both suitable situation and target are shown and results indicate that regression of model after training was near to 1 which means that after training and learning the aforesaid model was able to show all changes. In figure 7 the level of suitable input and output are shown.

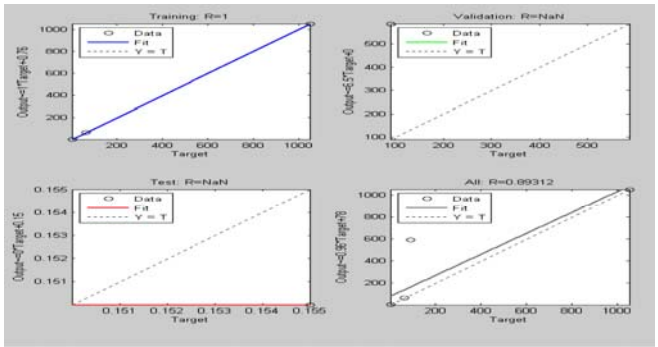

Figure 6: Showing Regression before and after Learning

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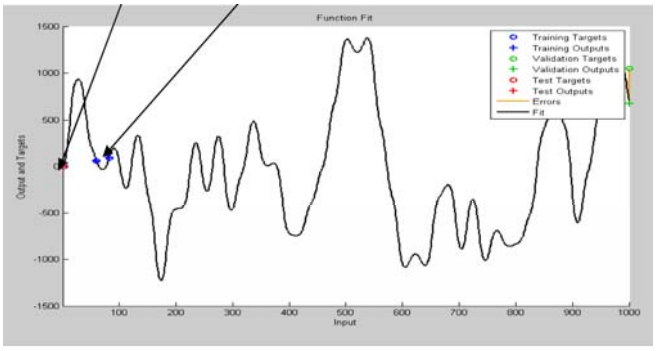

Figure 7: Comparing Suitable Level of Input and Output

After training and learning model of sensitivity analysis in first rank, the following results as description of table 2 will be offered:

Table 2: Mean Square of Error and Regression at First Rank Learning

	Sample	MSE	R
Training	5	349.36919e-0	9.78994e-1
Validation	1	141856.93984e-0	0.00000e-0
Testing	1	362.84907e-0	0.00000e-0

As it can be seen from table 2, Mean Square of Error (MSE) is a very high numerical amount. Under such conditions it is better to test learning model for next times. In table 3 the results of learning model at 5th rank has better status, therefore the hypothesis of research is certified.

Table 3: Mean Square of Error and Regression at 5th Rank Learning

	Sample	MSE	R
Training	5	1.32233e-22	1.00000e-0
Validation	1	5.29728e-0	0.00000e-0
Testing	1	6.41377e-3	0.00000e-0

VI. Conclusion

The necessity of attention to economical evaluation of industrial projects and correct selection of industrial projects is one of the most important problems of today, but since during recent years there were considerable advances in the field of financial management, in this article we attempted to deal with new field of this problem. The aim of present article is to use from artificial neural network and sensitivity analysis in problems and engineering economy projects. In this research after gathering assumed data and growing process of price in comparison to basic year we intended to design related neural network by using Matlab software to increase number of learning times, increase learning power and decrease squares of errors. Results of research indicated that factors including interest rate, depreciation and inflation have high sensitivity and other factors do not show considerable changes and have fixed slope with changes of time. Consequently sensitivity analysis model based on artificial neural networks has high ability for evaluating economical plans, so that this model can be used for investment engineering via accessing to dependable information for evaluating and selecting economical projects. Besides this model can help us to manage changes of important variables including interest rate, depreciation and inflation in management of capital projects.

References

[1] Aborzi Mahmoud (2001), Familiarity with Neural Networks, Scientific Publications of Sharif University of Technology, Tehran, (In Persian).

[2] Alexandra p. Jacquin, Asaad Y. Shamseldin (2006), Development of Rainfall-Runoff ModelsUsingTakagi-SugenoFuzzyInferenceSystem.Journal.

[3] Brige, John R & Li, Dayong(1996), using fuzzy neural network to solve short term load forecasting problems, university of Michigan,.

[4] Falah Ghaheri, Gholam Abbas, Kamyad, Ali Vahidian(2005), Application of Fuzzy ad Neural Systems, Fuzzy Inferential Systems and Field Systems for Anticipating Annual Rain, Iran.

[5] Ghazanfari, Mehdi, Kazemi, Zohreh (2008), Basics and Principles of Expert Systems, Science & Industry University of Iran Publications.

[6] Ghazanfari, Mehdi, Arkat, Jamal (2004), Neural Networks (Principles and Applications) science and Industry University of Iran.

[7] Haeri, Seyed Mohsen, Sadati, Naser, Mahin Rousta, Reza (2000), Using Neural Network for Anticipating Tension Behavior, Strain of Clay, Set of Articles at 5th International Civil Conference, University of Ferdousi of Mashhad, Iran.

[8] Halmar Halid and Peter Ridd (2002), Modeling Inter-Annual Variation of a Local Rainfall Data Using a Fuzzy Logic Technique.

[9] Hosseini, Seyed Mohammad and Amouzegar, Morteza (2008), Engineering Economy and Decision Making Analysis, Science & Industrial University Publications, Tehran.

[10] Jourabian, Mahmoud and Zare, Tanaz, Ostovar, Omid (2003), Artificial Neural Networks, Shahhid Chamran University of Ahvaz.

[11] Kia, Mustafa (2008), Neural Networks in Issues, Kian Rad Sabz.

[12] Lin, chin – Teng, Yeh, chang – Mao (2005), Support – cectore – based fuzzy neural networks', international Journal of computational intelligence research.

[13] Mehrjou, Ahmad (2007), Artificial Neural Networks, Islamic Azad University, Islamshahr Branch.

[14] Nikomaram, Hashem, Rahnamay Roodposhti, Fraydoon and Heibati, Farshad (2009), Basics of Financial Management, 1th and 2th Vol, Termeh Publications; Tehran.

[15] Oskonejad, Mohammad Mehdi (1986), Engineering Economy, Amir Kabir University of Technology Publications, Tehran.

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