Journal of Advances in Computer Research
Quarterly pISSN: 2345-606x eISSN: 2345-6078
Sari Branch, Islamic Azad University, Sari, I.R.Iran
(Vol. 11, No. 3, August 2020), Pages: 23-40
www.jacr.iausari.ac.ir

The Optimized Model of Factors Effecting on the Merger and Acquisition from Multiple Dimensions with Neural Network Approach

Mohammad Reza Eghbal[1], Seyed Ali Nabavi Chashmi[2 *], Naser Yadollahzadeh Tabari[3]
1) Ph.D. Student of Financial Engineering, Babol Branch, Islamic Azad University, Banol, Iran
2) Ph.D. Associated Professor, Department of Management, Babol Branch, Islamic Azad University, Banol, Iran
3) Ph.D. Assistant Professor, Department of Economey, Babol Branch, Islamic Azad University, Banol, Iran
rezaeg2010@mail.com; anabavichashmi2003@gmail.com; nasertabari@gmail.com

Received: 2019/10/11; Accepted: 2020/10/28

Abstract

Nowadays, firms apply the merger and acquisition strategy for gaining synergy, increasing the wealth of stockholders, economics of scales, enhancing efficiency, increasing the ability to research and develop, developing the firm and decreasing the risk. Developing an optimized model with the ability to identify the effective variables on the merger and acquisition process has a significant role on predicting the profit and the risk of companies involved in this process. Recently, regression-based approaches have been used for providing the optimized model. Regression method has some challenges such as sensitivity to considering the inner data structure, inability to addressing the non-linear relations between data, improper handling of data with continuous value. Neural network has the ability to more precise analysis of the relation between data due to lack of the challenges with regression method as well as examining both internal and external data structure. In one hand, since regression methods are the simplest type of neural method or neural method without hidden layer, developing regression method into neural network and concentrating on neural network and improving these networks can play more effective role on applying prediction in comparison with regression or other ordinary neural networks. Hence, this paper suggests using the optimized neural network for providing an optimized model in order to measuring the effective factors on the merger and acquisition process from multiple dimensions. The results from the experiments indicate the appropriateness of the optimal neural network-based model.

Keywords: Merger, Acquisitions, Network Approach, Strategic Alliance

1. Introduction

According to the researches carried out so far, since assessing the profit and loss from merger processes or predicting variables effecting on this process by machinery learning methods is constrained to methods including regression and its developed versions, therefore, it seems studying, examining, developing and improving the machinery learning methods are helpful and can reveal more the effect and power of artificial intelligence in the field of investment decisions in the merger and acquisition process(Aktaş, 2018; Leepsa & Mishra, 2017). One of the most popular methods of

neural network training is to use backpropagation algorithm. This algorithm can be applied for training multilayer networks. The algorithm is based on decreasing gradient in which the error slope is gradually reduced and network weights are adjusted to reach the least error(Hecht-Nielsen, 1992). In this paper, the post-backpropagation network is used in order to predict the variables effecting on the merger and acquisition process.

Numerous researches have examined the incentive of buyers or companies involved in purchase and merger process among which the most important incentives and goals are: creating synergy and diversification of activity that can be different according to the economic and time conditions and also the firm activity (Jiang, 2018; Schoenberg & Reeves, 1999). Also, as mentioned earlier, there were many research studying the factors effecting on the merger and acquisition process and or enormous research have studied the performance of merger and acquisition strategy on the performance of companies but there are little researches that have simultaneously tested the factors effecting on the merger and acquisition process and the fundamentals of the merger and acquisition process and measured the effects of these factors on the performance of firm (Dietrich & Sorensen, 1984; Jang & Chou, 1997). Hence, this research aims to measure the effect of merger and acquisition on the performance of companies in Iran Stock Exchange using the neural network approach after studying and determining the factors effecting on the merger and acquisition.

2. Research background

In recent years, despite the increasing use of corporate acquisition and merger strategies, there is no consensus on the effects of this strategy on the buyer and targeted companies. The carried out researches has obtained different results and often represent failing to achieve the merger and acquisition goals as the follow:

(Jiang, 2018)studied the factors effecting on the merger and acquisition of corporates through intelligent method based on machine learning method such as 10-k Filings. One of the main challenges of the method is their very high computation time. (Sandeep & Hiriyappa, 2019)studied the factors effecting on the merger and acquisition of corporates in India by using statistics methods. They found that the factors such as desirable government policies, economic development, corporate surplus liquidity and increased animatism level in IT domain have a key role in facilitating and changing the merger and acquisition process.

(Ombaka, Jagongo, & Finance, 2018) stated that most of merger and acquisition transactions are carried out with the aim of achieving financial synergy for taking advantages of the market power, entering into distribution channel or enhancing the access to developed geographical areas, so it can be claimed that technical reasons cannot simply cause to merger and acquisition, in other words, it cannot be explicitly emphasized that the merger and acquisition is not only inspired by technical reasons and it is linked to technology development, however, in current global situation, there are highly advanced professions that have brought significant competitions.

(Zhang et al., 2018) have studied the effect of merger and acquisition on the financial performance of emerging economics. The results show that when conditions are no longer changed, merger and value chain, merger and achieving to technology have positive relation with the firm performance and the correlation between mixed mergers and purchase and firm performance is not significant. Moreover, this study shows that the ability of firm to grow, the unique assets of the firm, and the size of firm has

positive effect of the performance of firm after they are merged, and that firm management, ownership and debt payment have no effect on the firm performance.

(HUI, YANG, HAN, & Industries, 2013) has classified the reasons for merger and acquisition into 5 classes. According his research, the fist reason is the change in the structure of SOE, especially in the structure of main companies. The second reason is the initial public offerings (IPO). Actually, because it is expensive and takes a lot of time to enter the Chinese capital market, merger and acquisition with the companies listed on the stock exchange can be a way for companies to enter this market, which caused poor performance of the Chinese capital market in 2012. The third reason is to enter a new business and change the structure of the firm. The fourth reason is arbitrage, meaning that some investors buy stock companies and after improving or changing their assets, sell them and make profit. And the last reason is the expansion of companies.

(Brătianu, Anagnoste, & Marketing, 2011) in their research as "the role of transformational leadership on the merger and acquisition in emergency economics" have analyzed the performance of transformational leadership in the developing economic. Their results showed that merger and acquisition indicate the evolving approaches in new markets or increasing market dominance over old markets .

(Ishmael, Adeoye, Folarin, & Research, 2012) In a research as "case study of the relation between the firm performance and the merger and acquisition" have analyzed the consequences of merger and acquisition on financial performance. Their research showed that eight reasons may effect on the performance of merger and acquisition activities: Payment method (cash or stock), book value to market value ratio, type of merger and acquisition transactions (relevant or irrelevant), cross-border or domestic merger and acquisition, merge against public purchase offers, firm size, macro-economic conditions and time period of deal .

(Vanitha, Selvam, & Economics, 2007) have investigated the financial performance of Indian companies before and after merger in 2000-2002. In this study, the criteria for success has been defined as the comparison between liquidity - leverage - profitability ratios three years before and after acquisition based on data from financial statements of the firm. The results show that acquisition in some Indian companies has led to improve the liquidity - leverage - profitability ratios.

(Nam, Pae, & Yi) in a research as "the post-merger performance prediction model" have developed a comprehensive model that considered the post-merger performance as a function of relative size, price-to-book ration, synergy, cost of equity and book value change and that these factors simultaneously affect the integration speed of the merger.

(Rottig & Practice, 2007) In a research as "successful management of international merger and acquisition: a descriptive framework", has claimed that most transactions made by multinational corporations with direct foreign investing are not successful. His research has identified the major challenges that led to the maximum failure of overseas merger and acquisition activities and provided a model of policies for ease of managing these challenges.

(Gugler, Mueller, Yurtoglu, & Zulehner, 2003) in their research as "the effect of merger on firm engagement in US and Europe" have studied the effects of merger and acquisition on a big part of stock market in Europe and US. Their research has not been able to discover the diverse effects of merger and acquisition on demands for workforce in US, however, the merger and acquisition in EU has decreased demand for workforce with an average of 10% which is fixed for those merger and acquisitions as an incentive to optimally regulate the number of employees and in other words to staff adjustment in

United States, because firm managers can do their business at any time for a small fee. The only type of emerge and acquisition activity that cause to decrease demand for workforce in US is the purchase acquisition through tender offers wherein violating "the malversation" (trustee abuse of trust property) is usually common and it naturally effects on decreasing workforce.

(Reed, Babool, Islam, & Review, 2003) in a research as "the effective factors on international merger and acquisition" have studied and collected the reasons which describe the reason for the formation of domestic and overseas merger and acquisition activities. They investigated the factors effecting on the merger and acquisition in countries like US, Australia, Canada, France, Germany, Japan and UK during 1987-1999. They used variables such as currency rate, interest rate and stock market price in their study and they used regression analysis method for separating and reviewing factors affecting the application of merger and acquisition strategies in the three industries including food, beverage and tobacco industries. Their research showed that the variables used (currency rate variables, etc., mentioned earlier) for explaining the inequality in the activity of merger and acquisition by the nation have been quiet significant, currency rate fluctuations in particular have a great elasticity effect on foreign merger and acquisition activities and it shows the factors such as the price is very essential in introducing foreign investing flows. This study also showed that the stock market index is absolutely affected by fluctuations in internal and external mergers and acquisitions. However, interest rate had a negative effect on the merger and acquisition activities in domestic and foreign models so that decreasing foreign flows of these activities will also lead to reduction in the interest rate.

(Schoenberg & Reeves, 1999) stated that, apart from individual characteristics of the firm, its industrial characteristics lead to encouraging the use of merger and acquisition activities and effect on this investing strategy. Indices such as industrial growth index and industrial concentration index which are one of the important characteristics of product market, in turn, they are among the significant factors influencing merger and acquisition activities. Moreover, factors such as deregulation in industry (environmental factors) at the industry level are also among the environmental factors affecting integration and acquisition. Hilli et al., (1992) stated numerous reasons mentioned by chief executive officers (CEO) to describe the merger or acquisition including gain synergy, economics of scale, cost savings, augmented products and Rationalization of production and distribution channel.

(Cooper- Thomas, Anderson, & psychology, 2002) found that one of the main reasons for the emergence of all coalitions and reorganization after the merger and acquisition strategy of the firm is the improvement and strengthening of its financial situation called as synergy effect. This synergies lead to improve the efficiency, savings from scale, market expansion, improved purchase power and consequently significant performance improvements.

Other experimental studies reported mixed results. (Pillania & Kumar, 2009) concluded that the comparison of profitability after merger, asset turnover and debt settlement of buyer companies with pre-merger mode don’t show any improvement. (King, Dalton, Daily, & Covin, 2004) Showed that merger and acquisition don’t lead to top financial performance, in other word, They believe that merger and acquisition has quite less negative effect on the long-term financial performance of acquired companies.

(Cabanda & Pajara-Pascual, 2007) reported that values before and after the merger yield mixed results. Some corporate performance measures such as total asset turnover,

which measures the efficiency of companies, show that there will be statistically significant profits in long-term analysis after merger and acquisition. Other performance variables such as return on asset, return on sell, capital expenditure, capital expenditure-to-sell ratio (CESA) and capital expenditure-to-total asset (CETA) after merger did not show any significant profit in short-term, and then it can be concluded that merger does not necessarily lead to improving the firm performance both in long-term and short-term.

Jahankhahi & Erfani (2007) in their research compared the financial performance of 57 target companies during 1997-2002 with the financial performance of non-acquired companies and after examining variables such as sales growth percentage, return on assets, return on equity and operating cash flow they concluded that the managers of buyer companies cannot improve the performance and create value for the owners of the companies and most of the firm's acquisition transactions in Iran have failed (Jahankhani & Bahadar , 2008).

In a research by Rahimi Boroujerdi (2005), the concept of economic liberalization includes eliminating all damages, limitations and obstacles created by policymaker and politic owners over the time in the normal way of macro-economic variables. In other words, this liberalization aims to eliminate imbalances from attempts to remove other imbalances and it should be done not by leaving the economy alone, but by reforming and monitoring the movement of the economy and variables and economic indicators (Rahimi Boroujerdi , 2005).

3. Research method

Despite the importance of predicting the analysis between the relation of factors effecting on merger and acquisition in investing system, little research has been done in this context. Therefore, it seems studying, examining, developing and improving machinery learning methods are useful and able to reveal more the effect and power of artificial intelligence in developing an effective and optimized model for predicting the factors effective on merger and acquisition and its effect on the firm performance. Thus, this section describes the use of optimized neural network intelligent method for predicting and measuring the relations between variables effective on the merger and acquisition and the effect of these variables on the firm performance. Therefore, the present study tries to identifies the factors effecting on the merger and acquisition of target companies by using improved neural network.

3.1. Research population and hypotheses

The research population is created based on the companies listed in Iran Stock Exchange. The reason for using these companies is initially because of data availability and then their data reliability. In this research, 84 exchange companies which have been merged and acquired, are used including: Sepah Bank, Kermanit, Maskan Bank, Saderat Bank, Datak Communications, Sepahan Bioproducts, Ardakan Iron, Shipping, Qeshm Pars Karaneh, Oil exploration operations, Karun Airlines, Petroleum Equipment Industries, Iran Helicopter, Soliran, Doural Aluminums, Farsit Ahvaz, Tehran Concrete, Pars Home Appliances, Del voroud Concrete, Zanjan Concrete.

Based on theoretical framework and research problem, two hypotheses are compiled to examine the relations raised in above as following:

1. The significant effect of merger and acquisition on the performance of companies listed in stock exchange.
2. The response of accuracy in predicting the effect of each factor under study on mergers and acquisitions has direct relation with the number of nerves in hidden layers and optimized adjustment of weighs in the neural network.
3. The merger and acquisition of companies has effect on the financial performance and firm's profitability.

3.2. Modern and simple meta-heuristic optimization based on finding the best answers

Metaheuristic is another name for meta-innovative or meta-evolutionary optimization methods. Metaheuristic optimizations usually imitate the behavior of an object or animal in nature, the chemical action-reaction behavior to solve nonlinear, complex and complex problems. Recently, Tomas (2016) has developed the metaheuristic optimization method based on imitating bird's behavior to find food. Since neural network measures the effect of each variable studied in the problem analyses the relations and correlations between them and usually the non-linear relations are available between variables and also such problem is known as a difficult problem, then optimizing such a problem i.e. analyzing the relations between variables with the neural network by metaheuristic method can lead to higher prediction accuracy and even decreased time of predicting and consequently decreased computation time. The main idea of Tomas based on providing initial solutions for the problem then evaluates the competency (the appropriateness or goodness of each solution) by using the following formula(Thomas & Mahapatra, 2016):

$$x_{i+1} = (x_{best} - x_i) * c1 \quad (1)$$

So that, x_i is the situation of each solution developed for each problem, x_{best} is the situation of best solution and x_{i+1} is the updated mode of the solution.

3.3. Improved neural network by optimizing meta-heuristic

One of the proper and simple solutions for strengthening a neural network is to optimize the weights connecting layers to each other in the neural network which is usually called the combined method in this case. One of the combined methods is the method of using neural networks along with metaheuristic optimization methods. The efficiency of neural networks is mostly influenced by its learning process in the educational complex. The multilayer perceptron neural network, which is simplest method of neural network, has two methods of training with an observer such as random method and gradient based method. One of most common gradient-based methods is the method of post-backpropagation and its developed versions which are very popular methods, which despite its simplicity and popularity it has disadvantages such as being caught in local optimizations, early convergence and excessive dependence on basic parameters. Thus, recently in different researches these networks are optimized by using metaheuristic method for covering the neural networks problems such as multilayer perceptron neural network with post-backpropagation training.

In this section, a multilayer perceptron neural network training method with post-backpropagation and improved training by metaheuristic optimization method of Tomas introduced in section 2.3, it is suggested to use the optimization strategy of weight coefficient applied in connecting neurons to each other in the process of neural network

training in order to improve the neural network by using in identifying the factors effecting on the merger and acquisition. Thus, at first, simple optimization based on finding best solutions for optimizing weights in neural networks has been used which will be discussed in detail below. The considered neural network is the backpropagation network that tries to optimize its weights by using a modern and simple optimization method based on finding the optimized answer in order to updating the best answers in each algorithm repeat. In the following, the way of optimizing weights in the neurons of neural network layers y using the modern and simple optimization method is described.

3.3.1. Problem modeling

The situation of each solution is considered as a bit binary string with the length of N where N denotes the total number of weights and biases in the supposed neural network. The value of each element at the array indicates the weights dedicated to the respective connection. Then, in each irritation the situation is updated through formula 1, the range of weights is considered in [-1, 1]. The total number of weights includes weights connecting the entering layer to the hidden layers and weights connecting the hidden layers to the outer layer.

3.3.2. Determining the fitness of problem

Fitness function is obtained by using formula (1). The accuracy from the neural network is considered as the fitness function (fitness measurement function).

The steps of the proposed method for solving the problem of weights optimization in neural network by using metaheuristic optimization method developed by Tomas is defined in the following (semi-code):

1. The maximum frequency and the number of solutions are determined in the searching space. The initial population of solutions, i.e. i=1,…,n, the x_i is developed. The number of solutions in the initial population is 45 based on trial and error experiments.
2. The situation of each solution is determined in the search space according to the section 1.3.3,
3. The fitness of each solution yields by using the accuracy of neural network (section 2.3.3). Since the situation of each solution is equal to randomly assigning of total weights to the target neural network, then the network is executed and achieves an accuracy by placing the initial random weights in the considered network. Here, the accuracy from the network is considered as the fitness of solution situation, and then the fitness of all the existed solutions in the population, which is equal to the accuracy from the neural network, is calculated.
4. The fitness of each solution is calculated,
5. Put the iteration to t = 1,
6. The solution situation is selected by the best fitness,
7. Each solution in the problem space is updated by approaching to the best global solution among all the solutions,
8. The solutions are arranged and the best answer x* is found,
9. If the irritation criteria t is reached to its maximum value, stop the method, otherwise set t=t+1 and refer to the step3.

3.3.3. The activation function in the improved neural network

The way this function works is that each activation function in the network receives a number and then a mathematical operation is carried out on the number and the output of activation function is a number placed in the range 0 to 1 or the range 0 to -1. In this work, the activation function of logistic type is considered.

3.4. Predicting the factors effecting on the merger and acquisition by using the improved neural network approach

In this section, the improved neural network method is used for two reasons so that in the first step it is suggested to use the improved neural network proposed in section 3.3 to analyze the relations between the studied variables and their effect on the merger and acquisition, then in the next step, the same improved neural network in section 3.3 is used for studying the effect of merger and acquisition on the performance and profitability of the firm.

As mentioned earlier in section 3.3, the selected neural network is of multilayer perceptron type which uses the backward propagation method for neural network training. The backpropagation network involves two parts. One part indicates the forward propagation of information and the second one is backward propagation of error. In forward propagation, the input information is sent through layers to the output, so that each layer effects only on the next layer. If the expected output is not achieved, the error will be calculated, the error will propagated to the previous layer, and based on the obtained error, weights and threshold of each layer will be set till the target and optimized goal is achieved. In order to predict and solve each problem by using the mentioned neural network, first of all several important factors including the number of input, output and hidden layers in the neural network and some adjustment parameters such as learning rate and learning type should be determined. The input and output layers are determined by using the information of the problem itself but the proper and optimized size of hidden layers and the nerves available in each of hidden layers are usually obtained through error and trial experiment. After determining the mentioned parameters, a type of validation method for testing should be tested and in other words, it should be used on the problem data after testing the developed neural network. So far many validation methods are provided which the most common and most widely used method is the mutual validation method of k-type (k fold). This validation method is a tool for evaluating the research method which operates based on the separation of data samples into training and testing parts, so that in this method the total number of sample transactions (data or records of stock transactions) is decomposed into k parts and each time one part of k (one fold) is considered as test sample and other parts (folds) as training samples. Thus, the nature of development and extension of problems to the solution by using the neural network is based on decomposing the data samples of the problem into two parts of training and test. First, some part of problem data, considered as the training part, is planned and trained by the determined neural network. Then, the sample data considered as the test part is used to test the developed neural network and predicting the expected responses and in other words, to predict the response of a new sample or the same test sample it is referred to the designed or trained network on the training data to obtain a predictive response. Sample data refers to traded equity of each firm so that the traded shares also involved characteristics such as independent variables described in table 1. Data samples are decomposed into two training and test parts. In training part, the improved neural network proposed in section 3.3 is taught with all the

training sample data along with response variables. The response (dependent) variable refers to the probability of effect of each factor or the same output feature. More clearly, it can be said that sample data of training part uses the studied variables which are expected to be effective in applying the merger and acquisition strategy, along whit the probability of the effect of each studied variables (output properties) for improved neural network training and teach the proposed neural network. Then, in test part, sample data without response variable (dependent), i.e. sample data tests the network only with information index values of independent variables and without awareness of the probability of the effect of each studied variables (dependent variable) to predict the probability of the effect of each studied transaction sample in the firm by using the taught network in the training part.

In order to assessing the effect of merger on the performance of the companies listed in over-the counter markets, the proposed hypotheses in the research hypothesis are tested by using the intelligent neural network. In the problem proposed in this paper, the factors of effecting on the merger and acquisition or those factors aiming to measure their effects on the merger and acquisition methods are considered as independent variable and the effect on the merger and acquisition and on the firm performance is considered as dependent variable (response). In neural networks, independent variables of the problem are known as input layer nerves and the response variable of the problem under study is known as the output layer nerves. Thus, the number of nerves in input and output layers is determined based on the information of the problem. For example, if the effect of the three variables on the merger and acquisition strategy is to be measured, the neural network then contains three nerves in the input layer and one nerve (response or dependent variable, which here indicates the type of effect (positive or negative) on the merger and acquisition) in the output layer. Since the goal is to examine the effect of several variables to assess their impact on mergers and acquisitions and to measure firm performance, then the performance is evaluated based on analyzing several variable. Thus, there are several variables which in turn aim to analyze each of response variables (the type of effect on the merger and acquisition method of the firm). In this part, the effect of factors such as firm performance, capital structures, firm size, and the growth of the firm's risk in the merger and acquisition and the firm performance is also considered, and in other words, the effect of merger and acquisition on the firm performance and the changes in financial companies using neural model is determined. Thus, there will be several dependent variables and two response variables which the details of each dependent and independent variables used in improved neural network are seen in table 1.

Table 1- The independent variables under study in the proposed improved neural network

Variable name	The concept
ROE	Return on Equity: The ratio of net profit after tax and the priority in gaining profit in the investment funds of firm i in the period t
ROA	Return on Asset: the ratio of net profit after tax to the total assets of the firm i (book value of assets) in the period t
MGR	Merger: Artificial variable (used to define nominal data) for firm i in period t, after merging, 1 otherwise it is considered 0.
TDA	Financial leverage control variable: the ratio of Total Debt to Total Net Assets of firm i in period t
SIZE	Control variable of firm size: Natural logarithm of the total assets of firm i in

Variable name	The concept
	period t
GRO	The growth control variable: annual changes in turnover, the number of shares exchanged by firm i on the total exchanged shares of firm i in period t
RISK	Control variable of firm risk: it is obtained by standard deviation of asset return at firm i in period t
EA	Exclusive assets of the firm: since the merger and acquisition has positive relation with asset monopoly (cording et al, 2002), Ratio of intangible assets to total assets is selected to measure the exclusive assets of the firm.
FPR: Firm property right	firm property rights and firm financial wealth
FGA: firm growth ability	firm growth ability The faster growth incentive of the firm is usually one of the important cases that contribute in increasing demand for merger and acquisition which is usually leads to improve the firm performance.
FS: firm solvency	Corporate governance One of the ways for controlling the merger and acquisition problems is to hire independent (non-executive) members on the board to monitor the manager's behavior. The independent members are professional managers with expertise in decision control. Their job is to carry out related problem activities between executive members and shareholders such as rewarding executives, inspecting and supervising to replace senior executives. Independent members support the shareholders' interests in better way and are better representatives for them.

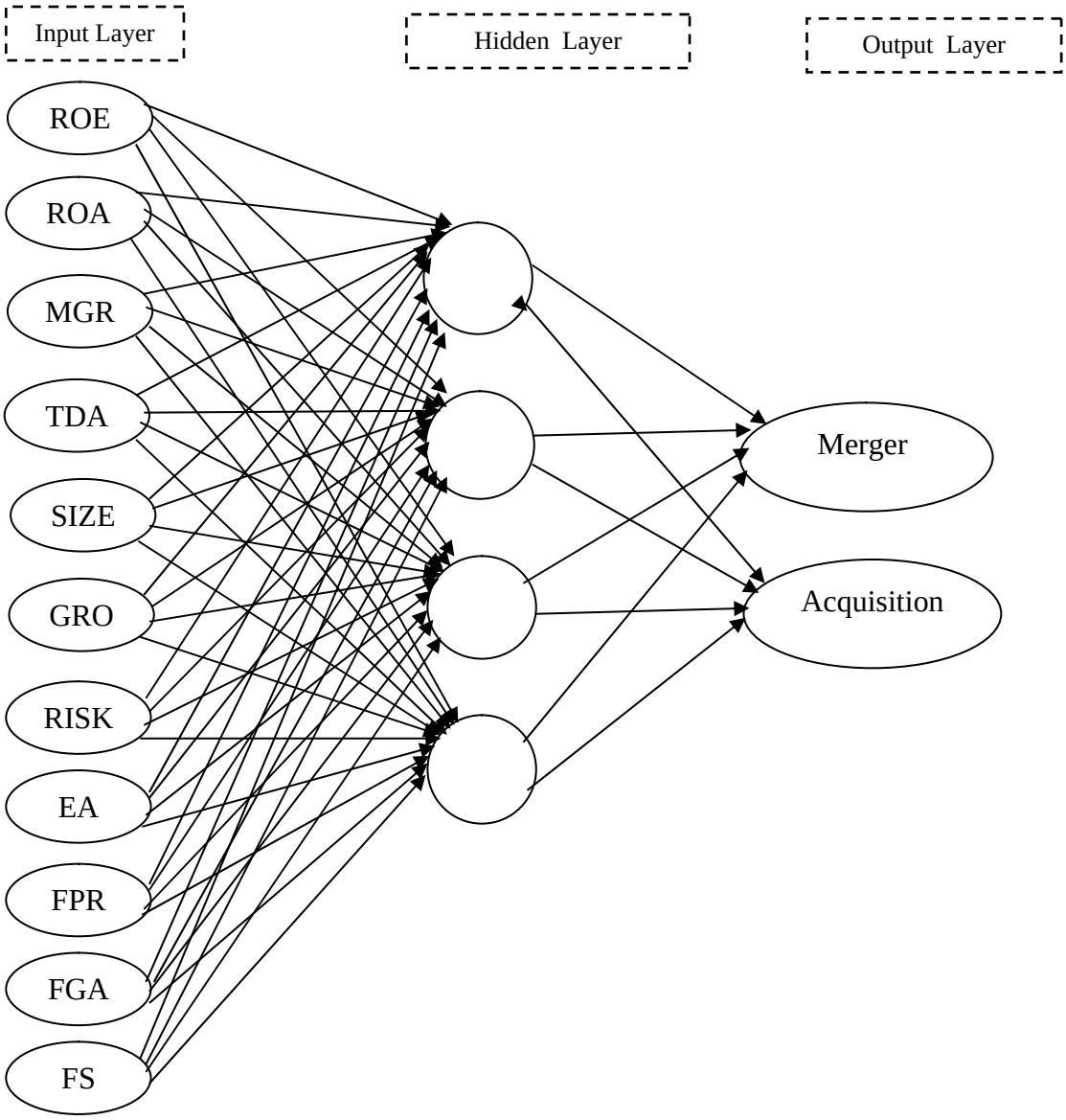

Figure1. Example of neural network for merger and acquisition

An example of the proposed neural network method for measuring the effect of variables affecting merger and acquisition is shown in Figure 1.

4. Findings

In this section the implementation of research method is studied and its findings are analyzed, the efficiency of the proposed research method is evaluated.

4.1. Correlation and analysis of the variance inflation

This research is carried out by the aim of evaluating the relation between the merger and acquisition with the firm performance in Iran Stock Exchange. The results are not

excluded not only from previous empirical findings that emphasized the negative impact of mergers and acquisitions on firm performance, but also it can be said in response to the first hypothesis that it does not support this fact that merger and acquisition lead to increase the firm profitability. The results indicate that merger and acquisition strongly hurt the return on equity after merging the firm that some of the possible reasons including this are the lack of highly experienced managers (usually managers with average and low experience), lack of a proper map for ensuring the effective implementation of merger and acquisition strategy, inability to managing cash flows from synergies created by mergers and acquisitions and mishandling of board room conflicts (Stock Exchange Brokerage Forum) after merging. As a result, it is essential that managers of merged or acquired companies make informed efforts to take the benefits of mergers and acquisitions, because you cannot always just face the benefits rather if there are no measures for proper management and use of benefits, disadvantages, the disadvantages may become more pronounced and the benefits after the merger and acquisition cannot be used.

The results indicate that merger and acquisition is not the only factor that can hurt the profitability of the merged firm but the firm risk and even firm size (measured by the total assets algorithm) will play an important role in firm profitability. Thus, it seems improper firm risk management and inefficient use of firm resources has effect on hurting the firm. It is also not clear why these abnormal functions are affected by mergers and acquisitions. However, debt capital and corporate growth are viewed as most important factor of profitability of merged firms in Iran Stock Exchange. Reducing the difference between financing through debt and equity and the benefits of expanding sales for the firms is useful. So, the results indicate that these factors identified can also link to the theory of the effect of capital structure in the proposed strategy.

In financial science, the way a firm invests is called capital structure. Capital structure includes long-term debts, preferred and common stocks. The value of investment and debt used in the firm should be selected by comparing the main characteristics of each type of securities influenced by the internal factors related to the firm or other external factors.

4.2. Mean relative error and mean absolute error

The method of mean relative error and mean absolute error are used for evaluating the fitness of the neural network method proposed in predicting the factors effecting on the merger and acquisition.

Mean absolute error. This measure is obtained from the sum of the differences between the predicted factors and all the considered effective factors (examined) in merger and acquisition. So that, according to the formula, for each acquisition, the difference between the predicted factors and actual factors is calculated for different time periods and then are summed together. In other words, the measure of mean absolute error is yielded by the sum of the difference between the predicted factors and the factors under study for each different time periods. The number of acquisition transactions for each firm is denoted by n.

$$\text{MAE}=\frac{1}{n}.\sum_{x=1}^{n}\left|t_{p_x}-t_{o_x}\right| \quad (2)$$

Mean relative error. This measure is obtained from the difference between the predicted factors and the factors under study in different time periods divided in the factors under study in the considered time period.

$$MRE=\frac{1}{n}.\sum_{x=1}^{n}\frac{|tp_x-to_x|}{to_x} \quad (3)$$

Since applying the neural method experiments requires to different settings such as hidden layers, it can be said that the rate of predicting factors error by using the neural method strongly depends on the number of hidden layers in the neural network and the values of the weights connecting the layers to each other. Connecting weights by using simple and new metaheuristic method has taken optimized and conscious values but error and trial experiments are used for setting the hidden layers. Trials and errors tests and prediction test of the factors were performed for different layers, including 5 to 20 layers. After examining the different values for the hidden layer, the results indicate the appropriateness of 14 hidden layers for predicting, so that, at first the network prediction error in 5 hidden layers has reached a significant amount and after that the prediction error rate has gradually decreased and we observed a downward trend in forecasting error, so that it has faced with a reduction in the forecast error rate to reach up to 14 hidden layers and after that there was no change in error rate from 15 to 20 hidden layers. It means the prediction method has reached convergence. Therefore, the analyses carried out by the neural network method with different settings indicate low prediction error rate for 14 hidden layers.

4.3. Validation of neural network prediction performance by regression test

The best epochs gained in each irritation are equal to 120 epochs. Figure 1 shows the mean error assessment index in each epoch up to 120nd epoch.

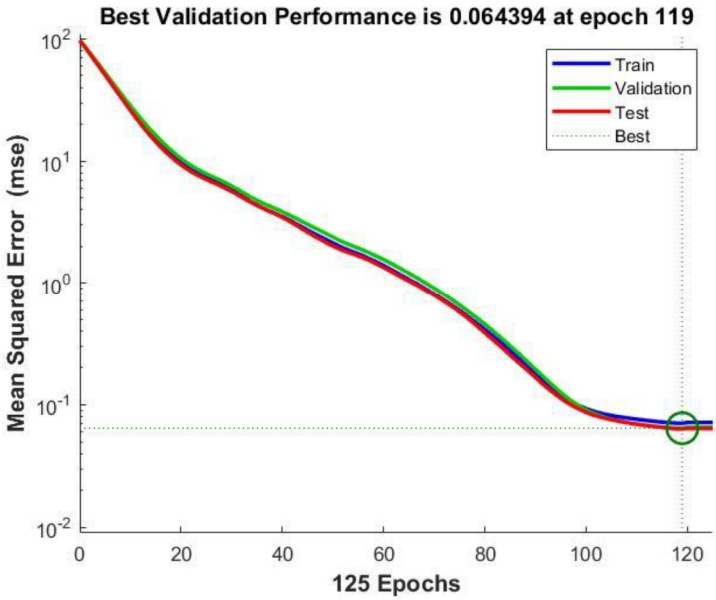

Figure 1- Performance of the proposed method in Sepah Bank

In figure 1, the graph shows the performance of predicting the effective factors in merger and acquisition. In this graph, as the epochs are increasing, we see a downward trend in the average of mean square error so that this error approaches zero, indicating the very proper accuracy of the proposed method so that the prediction error is greatly reduced and in contrast the prediction accuracy is increasing. This is because of this point that increasing the number of epochs in the neural network leading further

training. The more trained a network is, the better it will perform compared to a network with fewer epochs and less training.

Another way for measuring and validation of the performance of the proposed neural prediction is to apply regression test on such networks. Thus, the performance of network was validated by regression test on the prediction carried out by the neural network. The results from the regression analysis of the proposed optimized neural model are shown in figure 3. Moreover, the mean correlation between the predicted output and the actual sample data is about R = 0.8 and near to 1, suggesting the high accuracy of the proposed method in predicting and identifying the effective factors on the merger and acquisition. On one hand, the reason for obtaining the accurate value for R can be found in optimized setting of weights. Since one of the effective factors on the accurate R value is to apply weights and biases in the best possible way to the neural network. It can be concluded the new and simple metaheuristic optimization method applied in section 3.3 for improving and optimized adjustment of the weights connecting the layers together in the neural network had a successful performance in optimizing and applying the good weights and biases to the network.

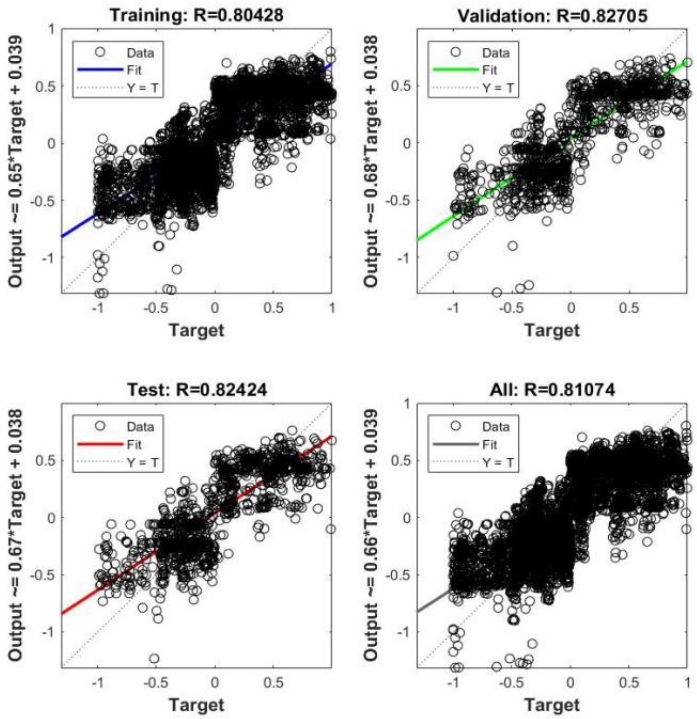

Figure 2- the graph of regression analysis on predicting the neural network

4.4. Validation of neural network prediction by k methods

One way to validate smart methods such as the neural method is to apply the mutual validation method. Various validations have different types including 30 to 70% separation, k methods and so on. In this section, k method (k fold) has been used to evaluate and test the nerve prediction. Table 2 shows the accuracy from the prediction method for each k test piece. The results from the accuracy of the proposed prediction method have been shown by testing on different firms in table 2.

This research investigates the performance of merged and acquired firms listed in stock exchange during 2013 to 2019 by using the growth, size, firm risk, the ability to grow indices. Thus, the information about the transactions carried out by using corporate financial statements are collected and the significance of the hypotheses results that financial risk and operation risk of firms has respectively increased and decreased after merger and acquisition comparing to the earlier period and the firm growth has increased and had a positive effect on the acquired and merged firms performance was examined by using fold 10 validation test. The results indicate that the financial risk of the acquired firms has increased after acquisition among which only the increase in the ratio of fixed assets to total debt was significant and the increase in other indicators was not significant.

k	Prediction accuracy
1	0.3622
2	0.5121
3	0.5650
4	0.5000
5	0.7528
6	0.6651
7	0.7455
8	0.4212
9	0.6452
10	0.8800

Table 2- the prediction accuracy in k validation

5. Conclusion

Considering to the increasing importance of merge and acquisition processes, increasing the number of target companies and lack of proper management of target companies and buyers in terms of measuring the firm's profits and losses and .. can pose serious challenges to the owners and shareholders of the target companies and the buyer. Various factors can effect on identifying the success of merging and acquiring a firm and consequently decreasing the risk of facing with lack of managing the financial performance of the firm and low profitability and high risk. These factors include Financial Leverage, firm size, firm growth, firm risk, exclusive assets of firm, firm property rights and firm financial wealth, corporate governance, Return on equity, Return on assets, book value-to-market value ratio, total firm assets, total firm debts, share price in the last transaction.

According to the results, the prediction from the neural network method has a high performance in predicting the factors effecting on the merger and acquisition. The accuracy of predicting characterized by the proposed strong neural method is more similar to the learning samples. Some of output data samples are not clear in the results from regression method in the learning sample but they are clear in improved neural network method. This means that the improved method improves the ability to simulate the common neural network method. Data samples of each firm such as profit and loss statements of each firm, cash flow, transactions made by each firm targeted for acquiring should not be processed by an equal neural method.

At the following, the research hypotheses are analyzed and affirmed.

Hypothesis 1: the merger and acquisition has significant effect on the firm performance listed in the stock exchange.

The analysis of the results from correlation, inflation variance and validation of neural network prediction performance analysis indicated that merger and acquisition did not cause to increase in the profitability of companies listed in stock exchange. The results indicate that merger and acquisition strongly hurts the return on equity after merging the firm and some main factors for this negative effect can include lack of experienced managers, lack of good map for ensuring the effective implementation of the merger and acquisition strategy, inability to manage the cash flow from synergy created by merger and acquisition and mishandling of board room conflicts after merger.

Hypothesis 2: the response of prediction accuracy and the effect of each factor under study in merger and acquisition have direct relation with the number of nerves in the hidden layers and optimized setup of weights in the neural network.

In the second hypothesis, it has been hypothesized that there is a direct relation between the response of prediction accuracy and the effect of each factor under study in merger and acquisition with the number of nerves in the hidden layers and optimized setup of weights in the neural network. According to the calculation of the mean relative error and the mean absolute error in the research findings section, the second hypothesis based on the direct effect of the hidden layer in predicting the variables affecting the acquisition and integration process was proved. In the research findings section, it has observed that with the increase in the number of hidden layers as well as the optimal and conscious adjustment of weights, the network has high accuracy and the prediction error is decreased. Therefore, it can be claimed that increasing the hidden layers in the neural network greatly leads to increase the prediction accuracy and then the second hypothesis is proved. At the follow, the mean relative error and mean absolute error are defined.

Hypothesis 3: the merger and acquisition of firms effect on the finance performance and the profitability of firms.

For the third hypothesis on the effect of merger and acquisition on the financial and the profitability of firms, there are evidences from predicting the neural network indicating that merger and acquisition has positive and significant effect on the firm profitability. Thus, this study supports the theories of value-creation after merger and acquisition. Therefore, the firms choose merger and acquisition for several reasons that some of them are qualitative and that the merging may be effective in achieving immediate goals but it may not provide all the theoretically defined benefits. In fact, based on studies and tests carried out in this research, it is a completely false to assume that merger activities are completely harmful to companies. In other words, it can be said that the merger and acquisition strategy is suitable for immediate goals and, although acquisition of companies may not cover all the benefits of mergers and acquisitions, is not without advantages. So, it is essential that the merger and acquisition strategy be properly planned, implemented and evaluated. Especially, efforts should be made to recruit and retain key personnel of merged companies through performance contracts or bonuses, appropriate measures must be taken to resolve conflicts of interest and a conscious effort must be made to obtain the expected benefits of the merger. Thus, the reason for the above measures is not merely limited to taking the benefits of mergers and acquisitions. Moreover, the results from model developed by the proposed neural network indicate that the firm size has negative relation with the profitability,

while debt capital and firm growth has positive relation with the profitability and it causes to increase the profitability.

References

[1] capital: A case study in high-technology industry," Expert Systems and Applications, 2008.

[2] Aktaş, M. J. A. J. o. E. M. (2018). IDENTIFYING THE EFFECTS OF MERGERS AND ACQUISITIONS ON TURKISH BANKS'PERFORMANCES. 6(3), 235-244.

[3] Brătianu, C., Anagnoste, S. J. M., & Marketing. (2011). The role of transformational leadership in mergers and acquisitions in emergent economies. 6(2).

[4] Cabanda, E., & Pajara-Pascual, M. J. J. o. B. C. S. (2007). Merger in the Philippines: Evidence in the corporate performance of William, Gothong, and Aboitiz (WG&A) shipping companies. 3(4), 87-100.

[5] Cooper- Thomas, H., Anderson, N. J. J. o. o., & psychology, o. (2002). Newcomer adjustment: The relationship between organizational socialization tactics, information acquisition and attitudes. 75(4), 423-437.

[6] Dietrich, J. K., & Sorensen, E. J. J. o. B. R. (1984). An application of logit analysis to prediction of merger targets. 12(3), 393-402.

[7] Gugler, K., Mueller, D. C., Yurtoglu, B. B., & Zulehner, C. J. I. j. o. i. o. (2003). The effects of mergers: an international comparison. 21(5), 625-653.

[8] Hecht-Nielsen, R. (1992). Theory of the backpropagation neural network. In Neural networks for perception (pp. 65-93): Elsevier.

[9] HUI, N., YANG, J.-n., HAN, Z. J. R., & Industries. (2013). APPROACHES TO POST-OPERATION OF CHINESE RESOURCES ENTERPRISES'TRANSNATIONAL MERGE AND ACQUISITION [J]. 3.

[10] Ishmael, O., Adeoye, A. O., Folarin, E. A. J. A. J. o. B., & Research, M. (2012). POST-BANK CONSOLIDATION: A debacle in the survival of SMEs in Nigeria" An Empirical Study". 2(8), 1.

[11] Jang, S.-L., & Chou, C.-H. (1997). Efficiency in the Taiwan banking industry. Paper presented at the National Taiwan University. Paper presented at the 1997 Taipei International Conference on Efficiency and Productivity Growth.

[12] Jiang, T. (2018). Using Machine Learning to Analyze Merger Activity.

[13] King, D. R., Dalton, D. R., Daily, C. M., & Covin, J. G. J. S. m. j. (2004). Meta□analyses of post□acquisition performance: Indications of unidentified moderators. 25(2), 187-200.

[14] Leepsa, N., & Mishra, C. S. J. S. M. J. (2017). Predicting the Success of Mergers and Acquisitions in Manufacturing Sector in India: A Logistic Analysis. 6(2), 44-73.

[15] Nam, C., Pae, Y., & Yi, J. Prediction Model of Post-merger Performance.

[16] Ombaka, C., Jagongo, A. J. I. A. J. o. E., & Finance. (2018). Mergers and acquisitions on financial performance among selected commercial banks, Kenya. 3(1), 1-23.

[17] Pillania, R. K., & Kumar, R. J. M. R. N. (2009). Post□merger corporate performance: an Indian perspective.

[18] Reed, M. R., Babool, M., Islam, A. J. I. F., & Review, A. M. (2003). Factors affecting international mergers and acquisitions. 6(1030-2016-82566).

[19] Rottig, D. J. I. B. R. T., & Practice. (2007). Successfully managing international mergers and acquisitions: A descriptive framework. 1(1), 103-126.

[20] Sandeep, N., & Hiriyappa, B. J. Z. I. J. o. M. R. (2019). An analytical study of pre and post evaluation merger & acquisitions of selected companies in India. 9(1), 214-223.

[21] Schoenberg, R., & Reeves, R. J. E. M. J. (1999). What determines acquisition activity within an industry? , 17(1), 93-98.

[22] Thomas, J., & Mahapatra, S. J. P. i. S. (2016). Improved simple optimization (SOPT) algorithm for unconstrained non-linear optimization problems. 8, 159-161.

[23] Vanitha, S., Selvam, M. J. I. R. J. o. F., & Economics. (2007). Financial performance of Indian manufacturing companies during pre and post merger. 12, 7-35.

[24] Zhang, W., Wang, K., Li, L., Chen, Y., Wang, X. J. T. F., & Change, S. (2018). The impact of firms' mergers and acquisitions on their performance in emerging economies. 135, 208-216.