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Development of Awarding System for Construction Contractors in Gaza Strip Using Artificial Neural Network (ANN)

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Abstract: ***The purpose of this paper is to develop a model for selecting the best contractor in the Gaza Strip using the Artificial Neural Network (ANN). The contractor's selection methods and criteria were identified using a field survey. Fifty four engineers were asked to fill a questionnaire that covers factors related to the selection criteria of contractors practiced in Gaza Strip. The results shows that the dominant part of respondents (91%) confirmed that the current awarding method "the lowest bid price" is considered one of the major problems of the construction sector, "award the bid to the highest weight after combination of the technical and financial scores" represented 50% of the respondents. The criteria weights were determined based on Relative Importance Index (RII . Ninety-one tenders(13 projects) were used to train and test the ANN model after re-evaluating the contractors depend on the weights of factors to select the best contractor who achieves the highest score. Neurosolution software was used to train the models. The results of the trained models indicated that neural network reasonably succeeded in selection the best contractor with 95.96% accuracy. The performed sensitivity analysis showed that the profitability and capital of company are the most influential parameters in selection contractors. This model gives chance to the owner to be more accurate in selecting the most appropriate contractor.***

Keywords: Contractor selection, ANN, Awarding system, Gaza Strip

I. Introduction

Contractors play a major role in projects, which is why contractor selection constitutes a critical decision for project owners. The selection process should embrace investigation of contractors potential to deliver a service of acceptable standard, on time and within budget [1]. Right selection of suitable contractors is critical for achieving good project performance and overall success in construction projects. In general, selecting eligible bidders is regarded as a vital safeguard for construction clients, especially in major/high value projects. The generic benefits of contractor selection process include healthy competitions, minimized risks, and improved quality potentials [2].

Awarding a construction contract to the lowest bidder without considering other factors can result in problems such as fraud, cost over-runs, delays, and poor performance. Therefore, contractors are often evaluated with multiple criteria including past quality performance, safety, cost, schedule, and relationship with owners [3].

The competitive bidding process in Gaza Strip is the most importance of its kind in the construction industry than in other sectors. It is more closely a pure competition. The most dominant way of awarding contracts in construction projects in Gaza Strip is the lowest bid method.

There were many problems in implementation as for the relationship between parties of projects and the efficiency & quality of works. Therefore, it is important to investigate the awarding policies and practices in projects in the Gaza Strip to select of suitable contractor for achieving good project performance and overall success in construction projects. Emphasis directed towards encouraging lowest bid price should be redirected towards establishing contractor's ability for achieving project owner's satisfaction by supplying high project performance (time) and high quality of completed product [1].

Selection of the best contractor to implement a project on time, within a reasonable cost and with an acceptable level of quality is a key factors for project success. The most appropriate solution to avoid contractor failure is to integrate technical and financial factors to select appropriate contractor.

II. Selection Process

Contractor evaluation and selection is a difficult and challenging task plagued with many uncertainties. It is a complex multi-attribute decision problem that requires individuals to make judgments and trade-offs between competing objectives and limited resources.

In a quest to identify a universal set of criteria suggested a suite of criteria to support contractor selection. These included managerial capability, financial soundness, technical personnel and their ability, past performance, experience, financial status, project management organization, and capacity to undertake or support the

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intended scope of work. In a subsequent article, Hatush and Skitmore reported a multi-criteria approach to contractor selection. Criteria included technical ability, health and safety, reputation, management capability, and bid amount (cost) [4].

Different countries use different procedures to select contractor. All these procedures are aimed at selecting a qualified contractor on a competitive basis, but in reality a decision is usually based on a single criterion. For instance, in Australia, contractor selection is based on different criteria and the process is implemented in two stages: first, the contractor's experience is evaluated and then comes bargaining for a price. In Saudi Arabia, the lowest bidder is selected provided that the bid is not less than 70% of the owner's cost estimate. In Turkey, a two stage procedure is used, but at the end, the lowest price determines the selection. In Canada and the USA, especially in the public sector, the ''lowest bidder" is selected. A bid bond in an amount equal to 10% of the bid price also has to be provided. In Lithuania, the ''lowest bidder" is selected as in Canada and the USA. In Iran, the ''lowest bidder" is selected. The selection is based on different criteria and two stage process, first the pre-qualification of all contractors is evaluated and then the lowest price mechanism works. Hence, it may be concluded that price criterion is decisive in contractor selection. Lately the ''lowest bid" selection practice has been criticized because it involves high-risk exposure to the client [5].

By far, the most frequently used method of selecting construction contractors is competitive bidding. Investigations into contractor selection and evaluation methods have more recently expanded. These methodologies include: Multi-Attribute Analysis (MAA), Multi-Attribute Utility theory (MAU), Fuzzy Set Theory (FST), Analytic Hierarchy Process (AHP) and An Artificial Neural Network approach (ANN).

MAA is a quantitative approach which facilitates the consideration of multiple attributes. Options being evaluated may be rated against the client's objectives. Preferences may be incorporated by assigning weights which then combined to yield the highest score indicating the optimal. In (MAU) all decisions involve choosing one, from several alternatives. Typically, each alternative is assessed for desirability on a number of scored criteria. What connects the criteria scores with desirability is the utility function. The most common formulation of a multi-criteria utility function is the additive model. FST theory resembles human reasoning in its use of approximate information and uncertainty to generate decisions. It was specifically designed to mathematically represent uncertainty and vagueness and provide formalized tools for dealing with the imprecision intrinsic to many problems. AHP design problem by breaking it down into a hierarchy of interrelated decision elements, decision criteria and sub criteria; After the decision problem is modeled in a hierarchical fashion, the decision maker must develop a set of comparison matrices that numerically define the relative preference of each decision alternative with respect to each criterion and also the relative importance of each criterion [5].

When selecting the best contractor, the following criteria of selection should be taken into consideration: technology and equipment, management, experience and knowledge of the technical staff, financial stability, quality, being familiar with the area or being domestic, reputation, and creativity and innovation. Despite setting several contractor selection criteria, the final decision should consider both; the criteria set and the competitiveness of the price [6].

El-Sawalhi et al., (2007) [7] said that the model that gives the best results should be able to meet the specific characteristic of the selection problem. The critical characteristics of the selection process are:

Selection process is a multi-criteria problem. The proposed model should do analysis of the criteria on a simultaneous basis.

Selection process contains risks inherited from different decision maker's opinion.

Selection process includes noisy and uncertain date given by different contractors.

Selection process contains subjective judgment made by decision makers.

Selection process includes non-linear relationships between contractor's attributes and their bid pricing with selection decisions.

The model should be able to adapt the results to suite changes associated between different contractors.

It should be able to deal with qualitative as well as quantitative data.

After extensive investigation of the published selection models, it is found that the Neural Network (ANN) is the most relevant model to cope with the above mentioned characteristics. It can perform tasks that a linear program cannot. When an element of the neural network fails, it can continue without any problem by their parallel nature. A neural network learns and does not need to be reprogrammed. It can be implemented in any application. It can be implemented without any problem. Due to all above reasons, this study selects a neural network method to develop a model for awarding system for construction projects in the Gaza Strip.

III. NEURAL NETWORK

An Artificial Neural Network (ANN) is a computational model that is inspired by the structure and functional aspect of biological neural network. The feature that makes the neural network more flexible and powerful is its ability to learn by example. The neural network has multi-disciplinary applications which include neurobiology, philosophy, economics, finances, engineering, mathematics and computer science, etc.. The first artificial neuron was produced in 1943 by the neurophysiologist Warren McCulloch and the logician Walter Pits. But the technology available at that time did not allow them to do too much [8]. Artificial neural networks consist of a large number of artificial neurons that are arranged into a sequence of layers with random connections between the layers. It can be arranged in different layers: input, hidden, and output. The hidden layer has no connections to the outside world because they are connected only to the input and output layers. Due to strong adaptive learning and fault tolerance capabilities many researchers have used neural network as prediction model in the field of construction management [9].

Artificial neural networks (ANN) adopted by Taha (1994), Khosrowshahi (1999), and Lam et al. (2000). It's advantages are: data-driven self-adaptive methods in that there are few a-priori assumptions about the models for problems under study. The statistical distribution of the data need not be known, non-convergence in the data is implicitly accounted for by the internal structure of the ANNs, suitable for analyzing the non-linear relationship between the output variables, ANNs results can be generalized capable of making both calculations and inferences on a complex combination of the quantitative and qualitative data, and uncertainties and inaccuracies were reduced to the lowest level, but it has some of disadvantages, it is hard for a neural network model to give an explanation as to why a candidate contractor was qualified or disqualified, the ANN are often criticized for exhibiting a low degree of comprehensibility, the ANN model suffers from the difficulties in the acquisition of training pairs for the private client’s projects, and the ANN requires a large amount of historical data for training [7].

IV. METHODOLOGY

An extensive review of previous studies, with structured questionnaire and expert interviews were used to identify the most influential factors on awarding system in Gaza Strip. The influential main factors were five groups (price of the bid, experience, technical ability, financial stability, and management capabilities). Ninety-one tenders were used to train and test the ANN model. The contractors were re-evaluated based on the weights of factors to select the best contractor who achieves the highest score. Neuro-Solution 5.07 application was used to train the models.

The researcher found that ANN technique is applicable and adaptable model among other used models in the selection process. The researcher determined the criteria of the selection process and its relevant factors that used in the design of the questionnaire. The questionnaire (a pilot study) focused on two parts. The first part was general questions and the second part was the main criteria and the relevant factors that affect the contractor selection. In this questionnaire, the most important factors were determined based on the relative importance index. Then based on the results of the questionnaire, the weights of the selection criteria were determined.

A. Questionnaire design

A structured questionnaire was used to identify the main parameters affecting awarding process in construction projects in Gaza Strip. Four main factors in awarding system are considered as follows: financial stability, management capabilities, experience, and technical ability in addition to the bid price. Twenty sub-factors are considered as follows: financial stability (Capital of the company, Liquidity, Debt volume, Bank facilities, Profitability), management capabilities (Organizational structure, Policy of health and safety, Experience of the managerial staff, Availability of training system, Use of computerized systems, Availability of monitoring, tracking, and evaluation system), experience (Number of projects implemented from 3 years, Amount of projects implemented from 3 years, The amount of similar projects implemented from 3 years, The adherence to the contractual period from 3 years), technical ability (Volume of equipment and machinery, Number of the technical staff, Experience of the technical staff, Technological means used, Classification of company). Seventy questionnaires were distributed to various engineering institutions. Fifty four questionnaires, as a response rate 77% of the total number of questionnaires, have been correctly answered and submitted.

For the need of many data to develop the neural network model, many historical projects done between 2010 and 2012 in Gaza Strip were collected from municipalities, government ministries, engineering institutions, contractors and consultants. Ninety-one contracts (13 projects) were used to develop ANN model which were used to re-evaluate contractors based on the weights of factors to select the best contractor who achieves the highest score.

B. Data Collection and Results

The sample size is 54 respondents consists of 33% as public owners, 6% as donors, 19% as NGOs, 15% as implementing agencies, 11% as consultants and 17% as other organizations. The majority of the respondents are involved in awarding process and this strengthens the results of the paper. The selection criteria and sub-criteria have been identified based on the statistical analysis results of the questionnaire to be the base for establishing the selection model in order to determine its weights as in formula No. 2 based on Relative Importance Index (RII) which is equal to as the following formula:

$$\text{(RII)} = \frac{\sum w}{AN} = \frac{\sum_{i=1}^{i=5} i \times n_i}{5N} \qquad \text{Eq. (1)}$$

Where w is the weight given to each factor by the respondent, ranging from 1 to 5, (n5 = number of respondents for Very Important, n4 = number of respondents for Important, n3= number of respondents for Medium Importance, n2 = number of respondents for Low Importance, n1 = number of respondents for No Importance). A is the highest weight (i.e.5 in the study) and N is the total number of samples. The RII equals ranges from 0 to 1.

The weight for each factor was calculated using the following formula:

Weight for each factor= RII /SUM (RII) Eq. (2)

The main factors for selection the best contractor are weighted as follows: "price of bid" is 50%,"experience" is 13.26%, "technical ability" is 12.92%, "financial stability" is 12.08%, and "management capabilities" is 11.74%. It was interaction between the financial and technical capacity to select the best contractor.

The twenty sub-factors are weighted as follows: financial stability (Capital of the company is 2.95%, Liquidity is 2.79%, Debt volume is 2.15%, Banking facilities is 2.36%, Profitability is 2.19%), management capabilities (Organizational structure is 1.98%, Policy of health and safety is 1.92%, Experience of the managerial staff is 2.2%, Availability of training system is 1.86%, Use of computerized systems is 1.84%, Availability of monitoring, tracking, and evaluation system is 1.95%), experience (Number of projects implemented from 3 years is 3.29%, Amount of projects implemented from 3 years is 3.38%, The amount of similar projects implemented from 3 years is 3.33%, The adherence to the contractual period from 3 years is 3.25%), technical ability (Volume of equipment and machinery is 2.66%, Number of the technical staff is 2.6%, Experience of the technical staff is 2.73%, Technological means used is 2.36%, Classification of company is 2.56%).

C. RE-evaluation

All contractors are re-evaluated based on multi procedures as follow: (Ts) is Technical Scores which represents the output of the submitted bids, (Fs) is financial scores of the submitted bids. The final cumulative score (CS) of the bids will be computed for both technical scores (Ts) and financial scores (Fs) based on a pre-defined formula. The bid will be awarded to the contractor whose proposal achieves the highest (Cs). The weights assigned to the selection criteria by the researcher are too close to the weights assigned by the respondents through the field investigation. The total weight of all criteria is equal to 100.

The lowest evaluated Financial Proposal (Fm) shall be given a maximum "Financial Score" (Fs) of 100 points. Then, the financial scores of any other financial proposals shall be computed based on the following formula:

$$Fs = 100 \times Fm / F \quad \text{Eq. (3)}$$

In which; Fs = Financial scores of any financial proposal under consideration, Fm =Amount of lowest financial proposal, F =Amount of the financial proposal under consideration.

The Final Cumulative Score (CS) of the proposals will be computed for both the technical scores (Ts) and financial scores (Fs) based on the following formula:

$$Cs = (Ts * 50\% + Fs * 50\%)/100 \quad \text{Eq. (4)}$$

The contract will be awarded to the contractor whose proposal achieves the highest score. The management capabilities factors are re-evaluated which have values between excellent and pass as in Table 1.

TABLE I
REQUIREMENTS FOR MANAGEMENT CAPABILITIES FACTORS

No.	Factor	Description	Requirements
1	Organizational structure	Excellent	General Manager+ Financial Manager+ managerial Manager+ secretary+ Accountant+ managerial employee
		Good	General Manager+ Financial Manager+ Accountant
		Pass	Accountant + Management employee
2	Policy of health and safety	Excellent	Plan+ training+ safety engineer
		Good	Plan
		Pass	Safety procedures
3	Experience of the managerial staff	Excellent	General manager > 20 years
		Good	10 years ≤ General manager ≥ 20 years
		Pass	General manager < 10 years
4	Training system	Excellent	Plan+ previous training
		Good	previous training
		Pass	workshops

All contractors are re-evaluated based on the weights of main and sub main factors. This process conducted through three steps. The first step is determining the weights of main and sub-criteria wich is calculated by using RII. The second step is collected all necessary information for all contractors with respect to the main and sub-criteria. The third step is determining the overall weight of all the contractors in order to select the best contractor. Table 2 presents this process.

TABLE II
RE-EVALUATION FOR CONTRACTORS

No.	No. of participant contractors	Lowest evaluated bid price	Factor's weight (CS) (%)	The best contractor based on re-evaluation
1	8	1.4	96.4	1.6
2	6	2.2	95.5	2.2
3	3	3.3	94.3	3.2
4	3	4.2	89.9	4.2
5	4	5.4	96.2	5.4
6	4	6.4	92	6.4
7	8	7.8	92.9	7.3
8	9	8.8	82.2	8.5
9	7	9.1	97.6	9.4
10	10	10.6	87.7	10.5
11	5	11.1	95.6	11.2
12	4	12.1	96.8	12.4
13	20	13.15	92.1	13.11

V. MODEL DEVELOPMENT

A Neural Network training program, NeuroSolution, was used as a standalone environment for Neural Networks development and training. Moreover, for verifying this work, a plentiful trial and error process was performed to obtain the best model architecture. In spite of great accuracy of using ANN in selection of the best contractor, it has a considerable defect, as it depends mainly on historical data; this dependency has several disadvantages as the following:

Diversity of variables for effective factors is limited to what available in collected data.

Data should contain sufficient projects for each variable.

New variables which were not included in adopted model will not be handled.

In this paper the most important project variables used in Gaza Strip were included. After analyzing the collected data, it is found that some limitations on input parameters should be assigned to give the best output. The available range of input data in ANN model are: price of bids has a range between 142000$ to 454110$ (100%-67.4%). The capital of the company ranges from 80000$ to 1500000 $ (100%-6.5%). Volume of projects implemented from 3 years ranges from 57500$ to 2333000 $ (100%-9.2%) and experience of the technical staff also ranges from 7 to 30 years (100%-30%). Figure I show the procedures of the model building.

A. Data Encoding

Artificial networks only deal with numeric input data. Therefore, the raw data must often be converted from the external environment to numeric form [10]. This may be challenging because there are many ways to do it and unfortunately, some are better than others for neural network learning [11]. In this paper data were converted to numeric form by dividing the inputs for each factor to ranges which were represented as numeric.

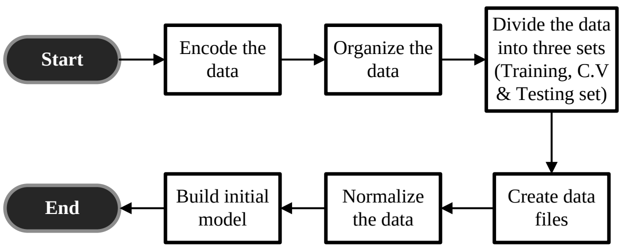

FIGURE I
PROCEDURES OF THE MODEL BUILDING

The developed model in this paper based on NeuroSolution 5.07 for Excel program. It was selected for its ease of use, speed of training, flexibility of building and executing the NN model. In addition, the modeler has the flexibility to specify his own neural network type, learning rate, momentum, activation functions, number of hidden layers/neurons, and graphical interpretation of the results. Finally, it has multiple criteria for training and testing the model.

B. Neural network training

The available data were divided into three sets namely; training set, cross-validation set and test set. Training and cross validation sets are used in learning the model through utilizing training set in modifying the network weights to minimize the network error, and monitoring this error by cross validation set during the training process. However, test set does not enter in the training process and it hasn't any effect on the training process, where it is used for measuring the generalization ability of the network, and evaluated network performance [12].

In the present paper, the total available data is 91 exemplars that were divided logical randomly, into three sets with the following ratio: Training set (includes 60 exemplars ≈ 66%), -Cross validation set (includes 16 exemplars ≈ 18%), and Test set (includes 15 exemplars ≈ 16%).

The objective of training neural network is to get a network that performs best on unseen data through training many networks on a training set and comparing the errors of the networks on the validation set [13]. Therefore, several network parameters such as number of hidden layers, number of hidden nodes, transfer functions and learning rules were trained multiple times to produce the best weights for the model.

As a preliminary step to filter the preferable neural network type, a test process was applied for most of available networks in the application. Two types Multilayer Perceptron (MLP) and General feed Forward (GFF) networks were chosen to be focused in following training process due to their good initial results. It is worthy to mention that, previous models that have been applied in the field of selection of the best contractor by neural networks used earlier two types of networks because of giving them the best outcome.

MLP is the most popular type of neural network currently in use which is commonly used in regression and classification problems. They are capable of modeling many functions but require a large amount of time, epochs, and nodes [14]. In (MLP), neurons are organized in several layers: the first is the input layer (fed by a pattern of data), while the last is the output layer (which provides the answer to the presented pattern). Between input and output layers there is one or more hidden layers which are comprised of the nodes chosen in the design phase. Each node of these takes the input values, associated weights, and runs them through the chosen function. The node then uses a transfer function to produce a weight-associated output. The hidden node values and weights are run through the output node (layer) algorithm, and a final output value is calculated [15].

GFF networks are a special case of MLP such that connections can jump over one or more layers; The GFF networks often solve the problem much more efficiently. A classic example of this is the two-spiral problem. Without describing the problem, it suffices to say that a standard MLP requires hundreds of times more epochs of training than the generalized feed forward (for the same size network) [11].

The procedures of the model training start with selecting the neural network type either MLP or GFF network. For each one, six types of learning rules were used, and with every learning rule eight types of transfer functions were applied, and then 3 separate hidden layers were utilized with increment of hidden nodes from 1 node up to 30 nodes in each layer. This process is done to obtain the best model having the best weight and minimum error percentage.

By another word, three thousand trials contain 30 variable hidden nodes for each was executed to obtain the best model of neural network. Three runs in each one 1000 epochs were applied. A run is a complete presentation of 1000 epochs; each epoch is a one complete presentation of all of the data [11]. However, in each run, new weights were applied in the first epoch and then the weights were adjusted to minimize the percentage of error in other epochs. To avoid overtraining for the network during the training process, an option of using cross-validation was selected, which computes the error in a cross validation set at the same time that the network is being trained with the training set.

As mentioned above, the purpose of testing phase of ANN model is to ensure that the developed model was successfully trained and generalization is adequately achieved. The best model that provided more accurate selection of the best contractor without being overly complex was structured of Multilayer Perceptron (MLP) includes one input layer with 21 input neurons and one hidden layer with (30 hidden neurons) and finally one output layer with one output neuron (the best contractor).

However, the main downside to using the Multilayer Perceptron network structure is that it required the use of more nodes and more training epochs to achieve the desired results. Table 3 summarizes the components of the model as number of hidden layer/nodes, type of network and transfer function.

TABLE III
COMPONENTS OF THE MODEL

Model Type	Transfer Function	Update Methods	Gradient Search
Multilayer Perceptron	SigmoidAxon	Batch	Momentum
No. of hidden layer	No. of PEs in the input layer	No. of PEs in the 1st Hidden layer	No. of PEs in the output layer
1	21	30	1

C. Results Analysis and Performance Measures of the model

The testing dataset was used for generalization that is to produce better output for unseen examples. Data from fifteen bids were used for testing purposes.

A Neurosolution test tool was used for testing the adopted model accordingly to the weights adopted. The results of fifteen bids with the real result of tested project compared with estimated result from neural network model, and an absolute error with both price and percentage are presented.

The most common statistical performance measures were applied on the adopted model to ensure the validity of this model in estimating the cost of new projects as the following:

The Mean Absolute Error (MAE) for the result from fifteen test project equals (0.0404). Difference between an estimated and the actual value of the projects is small. This result can be expressed in another form by accuracy performance (AP) according to Wilmot and Matsuura (2005) [16] which is defined as (100−MAPE) %. AP= 100% - 4.04% = 95.96%. This means that the accuracy of adopted model in conceptual phase is 95.96%. It is a very good result especially when no details are available.

Regression analysis was used to ascertain the relationship between the estimated and the recommended out put. The results of linear regression are illustrated graphically in Figure II.

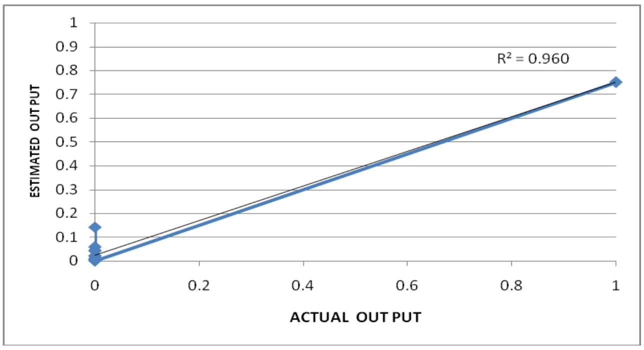

FIGURE II
LINEAR REGRESSION OF ACTUAL AND ESTIMATED RESULTS

The correlation coefficient (R) is 0.98, indicating that there is a good linear correlation between the actual value and the estimated neural network at test phase.

The results of performance measures are presented in Table 4, where the accuracy performance of adopted model is 95.96%. In which the average error is 4.04%.

TALBLE 4
RESULTS OF PERFORMANCE MEASUREMENTS

	MAE	MAPE	AP	R
MLP Model	0.0404	4.04%	95.96	0.98

Figure III describes the actual output compared with estimated output for test dataset. It is noted that there is a slight difference between two lines.

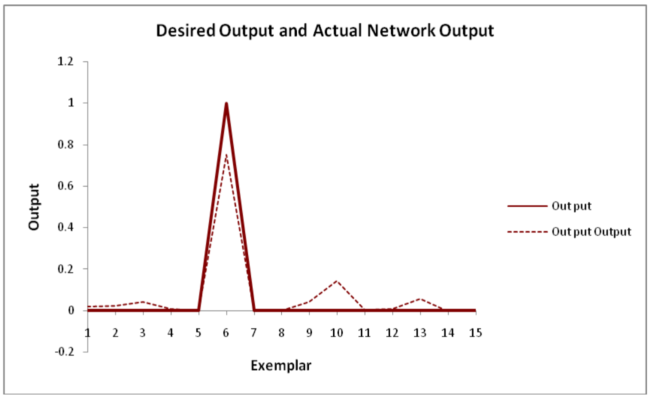

FIGURE III
COMPARISON BETWEEN DESIRED AND ACTUAL OUTPUT FOR TEST DATASET

Sensitivity analysis was carried out by Neurosolution tool to evaluate the influence of each input parameter to output variable for understanding the significance effect of input parameters on model output. Figure IV presents the sensitivity analysis results for each input parameter.

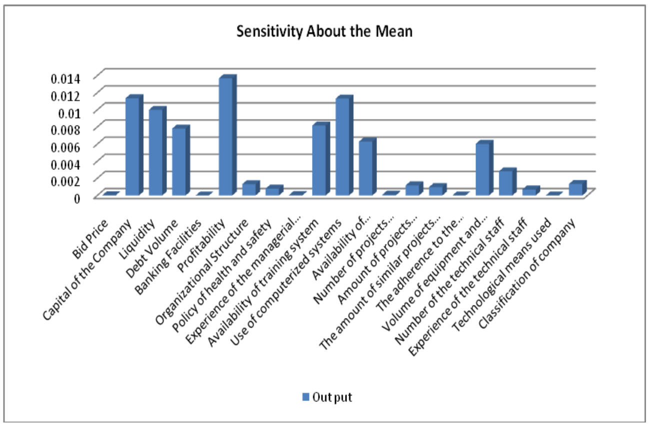

FIGURE IV
SENSITIVITY ABOUT THE MEAN

The increase of Standard Deviation refers to the strength influence of this parameter on the overall selection process. Figure IV shows that the profitability has the highest rate of influence on the selection process. Capital of the company has also a very significant influence, while the other parameters have a considerable gab of influence on selection of the best contractor. The results show that the chance of winning the tender is greater for the contractor who has higher profitability in projects and large capital of the company.

VI. Conclusion

Ninety one contracts were used to develop ANN model. Real bids collected from Gaza Strip organizations were divided randomly into three sets: training set (60 bids), cross validation set (16 bids), and testing set (15 bids).

The best model that provided more accurate selection of the best contractor was structured of Multilayer Perceptron (MLP) which includes one input layer with 21 input neurons and one hidden layer with (30 hidden neurons) and finally one output layer with one output neuron (the best contractor) .

The accuracy performance of adopted model in conceptual phase was 95.96%. It is a good result especially when no details are available. The developed model can be generalized if the same criteria were used in any other regions.

Sensitivity analysis was performed using Neurosolution tool. The test revealed that the profitability and capital of company had the highest influence. Therefore, the contractor who has higher profitability and capital has a greater chance of winning the tender.

The main contribution of this study is to give a chance for owners to be more accurate in selecting the appropriate contractor.

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