



**Cost Estimation for Iraqi School Building  
Projects Using Artificial Neural Network**

By

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**This Thesis was submitted in Partial Fulfilment of the Requirements**

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**Faculty of Engineering**

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# DETECTION

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To the first word to pronounce my tongue in the life (my dear Father & dear mother), to those who I cannot speak about them who supported me in my studies (my dear wife and my sons), to my brothers.

Mustafa Adnan Dawood,

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# LIST OF CONTENTS

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<b>AUTHORIZATION FORM.....</b>	<b>I</b>
<b>COMMITTEE DECISION .....</b>	<b>II</b>
<b>DETECTION.....</b>	<b>III</b>
<b>ACKNOWLEDGEMENT .....</b>	<b>IV</b>
<b>LIST OF CONTENTS .....</b>	<b>V</b>
<b>LIST OF FIGURES .....</b>	<b>IX</b>
<b>LIST OF TABLES .....</b>	<b>X</b>
<b>LIST OF EQUATIONS .....</b>	<b>XI</b>
<b>LIST OF ABBREVIATION.....</b>	<b>1</b>
<b>ABSTRACT.....</b>	<b>2</b>
<b>    CHAPTER ONE.....</b>	<b>3</b>
<b>INTRODUCTION.....</b>	<b>3</b>
1.1 <b>INTRODUCTION.....</b>	<b>3</b>
1.2 <b>PROBLEM STATEMENT .....</b>	<b>5</b>
1.3 <b>RESEARCH AIM AND OBJECTIVES.....</b>	<b>5</b>
1.4 <b>RESEARCH HYPOTHESES .....</b>	<b>6</b>
1.5 <b>RESEARCH JUSTIFICATION.....</b>	<b>6</b>
1.6 <b>RESEARCH METHODOLOGY.....</b>	<b>7</b>
1.7 <b>THESIS OUTLINE.....</b>	<b>9</b>
<b>    CHAPTER TWO.....</b>	<b>10</b>

<b>LITERATURE REVIEW .....</b>	<b>10</b>
2.1 LITERATURE REVIEW AND PREVIOUS STUDY .....	10
<b>CHAPTER THREE .....</b>	<b>16</b>
<b>ARTIFICIAL NEURAL NETWORK- BASIC CONCEPTS .....</b>	<b>16</b>
3.1 INTRODUCTION:.....	16
3.2 ARTIFICIAL NEURAL NETWORKS (ANNs): .....	17
3.3 APPLICATIONS OF NEURAL NETWORKS.....	18
3.4 ARTIFICIAL NEURAL NETWORKS STRUCTURE AND OPERATION:.....	19
3.5 TRANSFER FUNCTIONS .....	22
3.6 NEURAL NETWORKS LEARNING (TRAINING):.....	23
3.7 NEURAL NETWORKS TAXONOMIES: .....	23
3.7.1 <i>Single Artificial Neuron (The Perceptron):</i> .....	25
3.7.2 <i>Single Layer Artificial Neural Networks (SLANNs):</i> .....	26
3.7.3 <i>Multi-Layer Artificial Neural Networks (MLANNs):</i> .....	27
3.8 THE ERROR BACK-PROPAGATION: .....	28
3.8.1 <i>Algorithm of Error Back-Propagation:</i> .....	30
3.9 STATISTICAL MODELS:.....	32
3.10 APPLICATION OF ARTIFICIAL NEURAL NETWORK (ANN) IN ENGINEERING	

<b>CHAPTER FOUR.....</b>	<b>36</b>
<b>DATA ANALYSIS AND MODELING OF COST USING ARTIFICIAL NEURAL NETWORKS .....</b>	<b>36</b>
4.1 INTRODUCTION.....	36
4.2 METHOD OF DATA COLLECTION: .....	37
4.3 DISTRIBUTION DATA AMONG YEAR OF AWARD .....	37
4.4 DATA COLLECTION FOR SCHOOL BUILDINGS .....	37
4.5 UNIT COST ESTIMATION.....	38
4.6 DATA ACQUISITION.....	38
4.7 BUILDING ANN MODEL.....	40
4.7.1 <i>Neuframe Program.....</i>	<i>40</i>
4.7.2 <i>Data Pre-Processing, Division, and Scaling .....</i>	<i>41</i>
4.7.3 <i>Statistical Tests of Data Used .....</i>	<i>44</i>
4.7.4 <i>Model Architecture, Optimization and Stopping Criteria.....</i>	<i>46</i>
4.7.5 <i>Sensitivity Analysis of Inputs.....</i>	<i>52</i>
4.7.6 <i>ANN Model Final Equation.....</i>	<i>55</i>
4.7.7 <i>Model Final Equation: .....</i>	<i>56</i>
4.7.8 <i>Parameter Testing of ANN Model.....</i>	<i>58</i>
4.7.9 <i>Validity and Verification of the ANN Model Equation .....</i>	<i>59</i>
<b>CHAPTER FIVE.....</b>	<b>61</b>
<b>CONCLUSIONS AND RECOMMENDATIONS .....</b>	<b>61</b>



5.1	CONCLUSIONS .....	61
5.2	RECOMMENDATIONS .....	62
5.3	SUGGESTED FUTURE STUDIES .....	63
	<b>APPENDIX (A).....</b>	<b>A-1</b>
	<b>APPENDIX (B).....</b>	<b>B-1</b>
	<b>REFERENCES:.....</b>	<b>65</b>

# LIST OF FIGURES

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---

<b>Figure 1.1: Research methodology chart .....</b>	<b>8</b>
<b>Figure 2.1: Low-rise Prefabricated Structural Steel Building.....</b>	<b>13</b>
<b>Figure 3.1: Model of McCulloch and Pitts .....</b>	<b>18</b>
<b>Figure 3.2: Simplified scheme of biological neurons.....</b>	<b>18</b>
<b>Figure 3.3: Operations and Typical Structure of ANNs .....</b>	<b>20</b>
<b>Figure 3.4: The Logistic Sigmoid and Hyperbolic Tangent Transfer Functions. ....</b>	<b>22</b>
<b>Figure 3.5: Neural Networks Taxonomies (based on input and training rules).....</b>	<b>24</b>
<b>Figure 3.6: Neural Networks Taxonomies (based on network structure and training strategy).....</b>	<b>24</b>
<b>Figure 3.7: The Perceptron .....</b>	<b>25</b>
<b>Figure 3.8: Single Layer Neural Network.....</b>	<b>26</b>
<b>Figure 3.9: Multi-layer Neural Network .....</b>	<b>27</b>
<b>Figure 3.10: Error Back-Propagation Algorithm .....</b>	<b>29</b>
<b>Figure 4.1: Typical Neuframe 4 program components.....</b>	<b>41</b>
<b>Figure 4.2: RMSE% vs. no. of hidden layer nodes in the model .....</b>	<b>49</b>
<b>Figure 4.3: Relative impact of the work items on the model.....</b>	<b>55</b>
<b>Figure 4.4: Structure of the optimal ANN model.....</b>	<b>55</b>
<b>Figure 4.5: Observed vs. Predicted final cost school building model.....</b>	<b>60</b>
<b>Figure 4.6: Generalization of the ANN model construction cost school building .....</b>	<b>60</b>

# LIST OF TABLES

---

---

<b>Table 4-1: Input data based on the bill of quantity .....</b>	<b>40</b>
<b>Table 4-2: Performance of ANN model related to alternatives division .....</b>	<b>43</b>
<b>Table 4-3: The adopted for ANN model Input and output statistics .....</b>	<b>45</b>
<b>Table 4-4: Hypothesis test for model ANN input / output variables .....</b>	<b>46</b>
<b>Table 4-5: Number of nodes in hidden layer effect on the performance of model.....</b>	<b>48</b>
<b>Table 4-6: Momentum term effects on the performance of model .....</b>	<b>50</b>
<b>Table 4-7: Learning rate effect on the performance of model .....</b>	<b>51</b>
<b>Table 4-8: Transfer functions effect on the performance of model .....</b>	<b>52</b>
<b>Table 4-9: Threshold levels and weights connection of model .....</b>	<b>53</b>
<b>Table 4-10: Employing Garson’s algorithm technique on the model.....</b>	<b>54</b>
<b>Table 4-11: Case number (1 and 4) in Spare Data .....</b>	<b>57</b>
<b>Table 4-12: Statistical tests results for ANN model .....</b>	<b>59</b>

# LIST OF EQUATIONS

---

---

Eq. 3-1.....	20
Eq. 3-2.....	20
Eq. 3-3.....	23
Eq. 3-4.....	23
Eq. 3-5.....	25
Eq. 3-6.....	30
Eq. 3-7.....	30
Eq. 3-8.....	30
Eq. 3-9.....	31
Eq. 3-10.....	31
Eq. 3-11.....	31
Eq. 3-12.....	31
Eq. 3-13.....	31
Eq. 3-14.....	31
Eq. 4-1.....	44
Eq. 4-2.....	56
Eq. 4-3.....	56
Eq. 4-4.....	56
Eq. 4-5.....	56
Eq. 4-6.....	56
Eq. 4-7.....	56

<b>Eq. 4-8.....</b>	<b>56</b>
<b>Eq. 4-9.....</b>	<b>58</b>
<b>Eq. 4-10.....</b>	<b>58</b>
<b>Eq. 4-11.....</b>	<b>58</b>
<b>Eq. 4-12.....</b>	<b>58</b>

# LIST OF ABBREVIATION

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AI	Artificial Intelligence
ANN	Artificial Neural Network
$\theta_j$	Bias or Threshold for Node j
$d_k$	Desired Output of Neuron K
$I_j$	Activation Level of Node j
MAPE	Mean Absolute Percentage Error
NN	Neural Network
PE	Processing Element
SSE	Sum Square Error
R	Correlation Coefficient
$R^2$	Coefficient of Determination
MPE	Mean Percentage Error
RMSE	Root Mean Squared Error
AA%	Average Accuracy Percentage
RBNN	Radial Basis Neural Network
SPSS	Statistical Package Society Science
TANSIG	Hyperbolic Tangent Transfer Function
$W_{ij}$	Connection Weight between Node i and j
$W_{jk}(n)$	Weight Correction
$W_{jk}(n-1)$	Previous Weight Correction
$X_i$	Inputs
$Y_j$	Output of Node j
$\eta$	Learning Rate
$\alpha$	Momentum Term
$\delta$	The Error Back propagation
CECPBSB	Cost Estimation of Construction Project (schools buildings)

# **Cost Estimation in a Construction Project Using Modern Intelligent Techniques**

*By*

**Mustafa Adnan Dawood**

## **Abstract**

The actual final cost of public-school building projects, like other construction projects, is unknown to the owner till the final account statement is prepared. An attempt to estimation the final cost of such projects before work starts, using Neural Network analysis technique is carried out. The study covers (12 & 18 classes) school projects awarded by the lowest bid system, they were obtained by the UNDP, Anbar Provincial Education Directorate and Anbar Reconstruction Fund Committee. Records of (60) school projects completed during (2010-2018) are employed to develop and verify the model. The most important part of the tender documentation for school building, upon which the preliminary estimate of cost is based on the bill of quantities, works were divided into ten groups are considered to have the most significant impact on the final cost. Hence, they are used as model input parameters. These groups are site works, concrete works, “windows, doors and steel works”, “plastering and painting works” tiling works, sanitary works, fire extinguisher, Electrical works, outer works, and numbers of classes. It was found that the developed model has the ability to predict the final cost (FC) for school projects, as an output, with a very good accuracy having a correlation coefficient (R) of (98.1%), determination coefficient ( $R^2$ ) of (96.2%) and average accuracy percentage of (99.55%).