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DEVELOPING COST PREDICTION MODEL FOR BUILDING PROJECT : CONCLUSION

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Abstract - *The critical problem in the construction industry is that building projects are completed at cost much higher than estimated project cost, hence it is essential to develop a cost prediction model that imprison all factors affecting the project cost using regression analysis through set of objectives such as: to locate the factors affecting the project cost; analyze the significance of the factors and develop cost predictive model. Literature review on the study stipulates that nature of clients, professional involved in a project and their choice regarding design, function, duration, technology and execution have significant effect on the overall project cost. Data for the study are obtained through random sampling of building projects completed in various location. The study points out the seven most exceptional factors to project cost such as: design related factors, time or cost related factors, parties experience related factors, financial issues related factors, bidding situations related factors , project characteristics related factors and estimating process related factors. These selected key factors are to be used for cost predictive model. The cost prediction model is developed with the help of SPSS software.*

***Key Words*: SPSS MODEL, Cost estimation, Cost prediction model.**

1. INTRODUCTION

1.1 Scope and Research objectives

The research goal is to provide investors in the construction business with a tool to predict and quantify substantial risk associated to change. A regression model is developed in this research to predict project delay and cost increment using real project data of different construction types and different sizes for each type. Many factors affect accuracy of construction projects cost estimating. Through this study, factors affecting building construction projects cost estimating are discussed. Design-bid-build projects, executed by private companies in an open tendering are selected for the scope of this study. The main objectives of this study are:

[1] Identifying factors affecting the accuracy of the building construction projects cost estimating process.
[2] Determining and testing the severity of factors that affect the accuracy of the building construction projects" cost estimating using analysis of data collected from questionnaire form.
[3] Measuring the effects of the factors that severely affect the accuracy of the cost estimates and trying to link them.
[4] Developing a model that can be used to assess the expected cost variance. Identifying such variance can help in accurately determining the risk premium that should be added to the estimated cost.

2. RESULTS AND DISCUSSIONS

2.1Response result

Table 3.1: Response Rate of Factors

VARIABLE NAME	FACTORS THAT DETERMINE COST OF BUILDING PROJECT	EI (5)	VI (4)	MI (3)	SI (2)	NI (1)
i) Design related factor						
F1	Design complexity	20	52	14	0	0
F2	Construction complexity	23	44	19	0	0
F3	Technological advancement	14	36	26	10	0
F4	Specialization required of contractors	8	29	34	13	2
F5	Percentage of repetitive elements	8	16	38	19	5
F6	Presence of special issues	2	22	41	20	1
F7	Type of specification	1	23	38	23	1
F8	Extent to which bid documents allow additions to scope	6	23	41	16	0
F9	Flexibility of scope of works when contractor is hired	7	27	51	1	0
F10	Project scope definition completion when bids are invited	2	45	34	5	0
F11	Design completion(by owner) when bids are invited	0	4	45	37	0

F12	Design Decision made (by owner) when bids are invited	2	22	40	19	3
F13	Design completion when budget is fixed	23	43	20	0	0
ii) Time/cost related factors						
F14	Significance for project to be completed within budget	34	46	6	0	0
F15	Importance for project to be delivered	2	29	48	7	0
F16	Time given to consultant to evaluate bids	0	27	40	19	0
F17	Extent to which contract period is allowed to vary	6	36	33	11	0
F18	Importance for project to be completed on time	32	48	5	0	1
F19	Bidding environment	2	29	42	13	0
F20	Consultant's level of construction sophistication	19	46	21	0	0
F21	Owner's level of construction sophistication	8	33	35	10	0
iii)Parties experience related						
F22	Contractor's experience with similar project	33	46	7	0	0
F23	Owners experience with similar project	1	22	49	14	0
F24	Consultant staffing level to attend to contractor	0	23	44	19	0
F25	Owners staffing level to attend to contractor	0	14	51	21	0
F26	Consultant's experience with similar type of projects	1	26	48	11	0
F27	Contractor's experience with similar size of projects	13	47	23	3	0
F28	Contractors experience with project in location	1	33	43	9	0
F29	Subcontractor experience and capability	3	29	34	18	2
F30	Communication among project team	36	43	6	1	0
F31	Contractor's prior working relationship with the owners	0	28	42	16	0
F32	Contractor prior working relationship with consultant	0	21	51	13	1
F33	Contractor track record for completion on time	3	37	37	8	1
F34	Contractor track record for completion on quality	2	28	46	10	0
F35	Contractor track records for completion on budget	28	57	1	0	0
F36	Contractor staffing level	0	20	44	22	0
F37	Adequacy of contractor plant and equipment	0	12	49	25	0
F38	Magnitude of change orders in contractor past project	4	46	33	3	0
iv)Financial issues						
F39	Accuracy of estimated financing cost	2	54	28	2	0
F40	Availability of management and finance plans	8	49	29	0	0
F41	Economic instability	4	44	36	2	2
F42	Uncertainty of taxes	1	23	45	17	0
F43	State of market	2	21	44	19	0
F44	Periodical payments	2	36	39	9	0
F45	Currency exchange fluctuation average	0	29	44	13	0
F46	Inflation pressure	1	25	40	20	0

v)Bidding situations						
F47	Level of competition	2	28	41	15	0
F48	Number of competitors	1	21	42	22	0
F49	Time between project announcement and bid opening average	1	4	55	26	0
F50	Accuracy of bidding documents provided by client	0	13	59	14	0
vi) Project Characteristics						
F51	Type of contract	0	13	47	26	0
F52	Size of contract	0	29	44	13	0
F53	Project location	0	27	39	20	0
F54	Site condition	1	22	50	13	0
F55	Competent and leadership of project manager	0	25	44	17	0
F56	Experience and incentives of field staff	0	22	41	23	0
F57	Quality of firm's project planning and management	1	27	40	18	0
F58	Labor and equipment required	0	22	44	20	0
F59	Contract period	0	44	32	10	0
F60	Content of the project specifications	0	29	46	11	0
F61	Punitive damages	2	26	42	16	0
F62	Arbitration clause	0	22	49	15	0
F63	Knowledge of client and consultant average	1	3	36	36	10
F64	Attitude towards changes	0	4	35	37	10
F65	Environmental issues	0	4	34	36	12
F66	Impact of project schedule	0	7	37	36	6
F67	Quality of specification code	0	10	41	27	8
F68	Unforeseeable change in local laws and procedures	0	10	43	25	8
F69	Weather	1	8	36	36	5
F70	Nationality of labor	0	3	36	32	15
F71	Social and cultural impact	0	0	26	49	11
F72	Religious regulations	0	0	17	47	22
F73	Estimating method	4	10	26	35	11
F74	Public exposure	1	4	39	27	15
vii)Estimating process						
F75	Availability of productivity standards	0	4	41	36	5
F76	Availability of cost indexes average	1	1	47	31	6
F77	Relevant experience of estimating team	1	37	41	7	0
F78	Ability of estimating team	0	16	47	16	7
F79	Standard procedure for updating cost information	2	26	47	10	1
F80	Method used in determining contingency	6	22	38	16	4

2. Calculation of relative importance index (RII)

Table 2.1 : Calculation of Relative Importance Index (RII)

VARIABLE NAME	FACTORS THAT DETERMINE COST OF BUILDING PROJECT	RII VALUE
i) Design related factor		
F1	Design complexity	0.81
F2	Construction complexity	0.81
F3	Technological advancement	0.72
F4	Specialization required of contractors	0.66
F5	Percentage of repetitive elements	0.60
F6	Presence of special issues	0.61
F7	Type of specification	0.6
F8	Extent to which bid documents allow additions to scope	0.64
F9	Flexibility of scope of works when contractor is hired	0.69
F10	Project scope definition completion when bids are invited	0.67
F11	Design completion(by owner) when bids are invited	0.52
F12	Design Decision made (by owner) when bids are invited	0.60
F13	Design completion when budget is fixed	0.80
ii) Time/cost related factors		
F14	Significance for project to be completed within budget	0.87
F15	Importance for project to be delivered	0.66
F16	Time given to consultant to evaluate	0.62

	bids	
F17	Extent to which contract period is allowed to vary	0.68
F18	Importance for project to be completed on Time	0.85
F19	Bidding environment	0.64
F20	Consultant's level of construction sophistication	0.79
F21	Owner's level of construction sophistication	0.69
iii) Parties Experiences Related		
F22	Contractor's experience with similar project	0.86
F23	Owners experience with similar project	0.62
F24	Consultant staffing level to attend to contractor	0.61
F25	Owners staffing level to attend to contractor	0.58
F26	Consultant's experience with similar type of projects	0.64
F27	Contractor's experience with similar size of projects	0.76
F28	Contractors experience with project in location	0.66
F29	Subcontractor experience and capability	0.63
F30	Communication among project team	0.86
F31	Contractor's prior working relationship with the owners	0.62
F32	Contractor prior working relationship with consultant	0.61
F33	Contractor track record for completion on time	0.67
F34	Contractor track record for completion on quality	0.65
F35	Contractor track records for completion on budget	0.86
F36	Contractor staffing level	0.59
F37	Adequacy of contractor plant and equipment	0.57
F38	Magnitude of change orders in contractor past project	0.72
iv)Financial issues		
F39	Accuracy of estimated financing cost	0.73
F40	Availability of management and finance plans	0.75
F41	Economic instability	0.72
F42	Uncertainty of taxes	0.62
F43	State of market	0.61
F44	Periodical payments	0.67
F45	Currency exchange fluctuation average	0.64
F46	Inflation pressure	0.62
v)Bidding situations		
F47	Level of competition	0.64
F48	Number of competitors	0.6
F49	Time between project announcement and bid opening average	0.55
F50	Accuracy of bidding documents provided by client	0.59
vi) Project Characteristics		
F51	Type of contract	0.57
F52	Size of contract	0.64
F53	Project location	0.62
F54	Site condition	0.62
F55	Competent and leadership of project manager	0.62
F56	Experience and incentives of field staff	0.59
F57	Quality of firm's project planning and management	0.62
F58	Labor and equipment required	0.6
F59	Contract period	0.68
F60	Content of the project specifications	0.64
F61	Punitive damages	0.63
F62	Arbitration clause	0.62
F63	Knowledge of client and consultant average	0.48
F64	Attitude towards changes	0.47
F65	Environmental issues	0.47
F66	Impact of project schedule	0.5
F67	Quality of specification code	0.52
F68	Unforeseeable change in local laws and procedures	0.53
F69	Weather	0.52
F70	Nationality of labor	0.46
F71	Social and cultural impact	0.43
F72	Religious regulations	0.38
F73	Estimating method	0.51
F74	Public exposure	0.48
vii)Estimating process		
F75	Availability of productivity standards	0.5
F76	Availability of cost indexes average	0.51
F77	Relevant experience of estimating team	0.67
F78	Ability of estimating team	0.56
F79	Standard procedure for updating cost information	0.64
F80	Method used in determining contingency	0.62

2.2 Position of rank in each factors

2.2.1. Design related factors

The factor number DF1 that represents the Design complexity and DF2 Construction complexity which has the highest RII Value i.e. 0.81 (shown in red color in graph) therefore, it has highest rank i.e.1

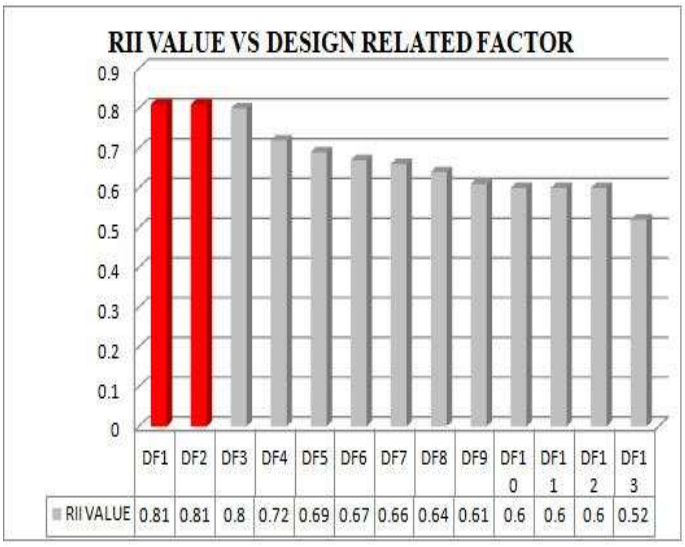

Fig 2.1: RII value of design related factors

2.2.2 Time or Cost related factors

The factor number TF1 that represents the factor, Significance for project to be completed within budget which has the highest RII Value i.e. 0.87therefore, it has highest rank i.e. 1.

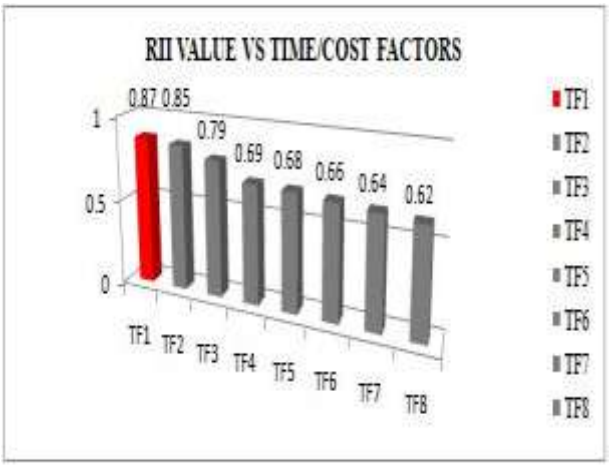

Fig 2.2: RII value of Time/ Cost related factors

2.2.3 Parties experience related factors

The factor number PF1 that represents the factor, Contractor's experience with similar project, PF2 that Communication among project team and PF3 Contractor track records for completion on budget which has the highest RII Value i.e. 0.86(shown in red color in graph) therefore, it has highest rank i.e.1.

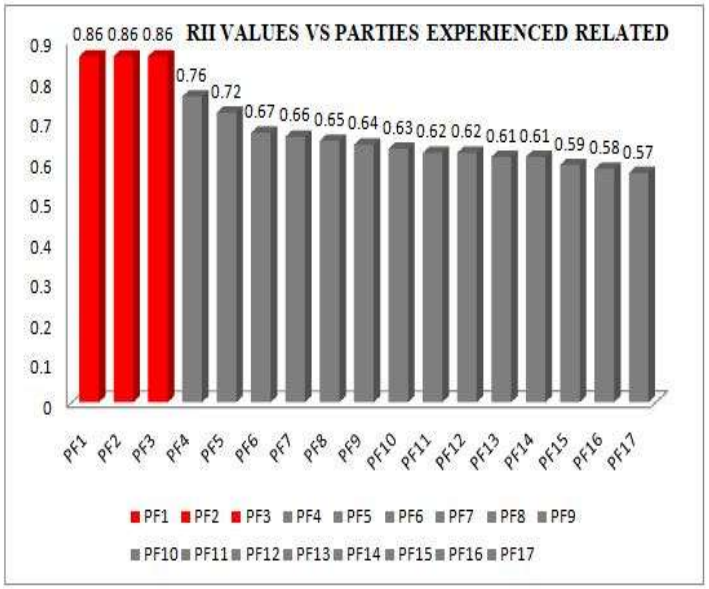

Fig. 2.3: RII value of parties experience related factors

2.2.4 Financial issues

The factor number FF1 that represents the factor, availability of management and finance plans which has the highest RII Value i.e. 0.75(shown in red color in graph) therefore, it has highest rank i.e.1

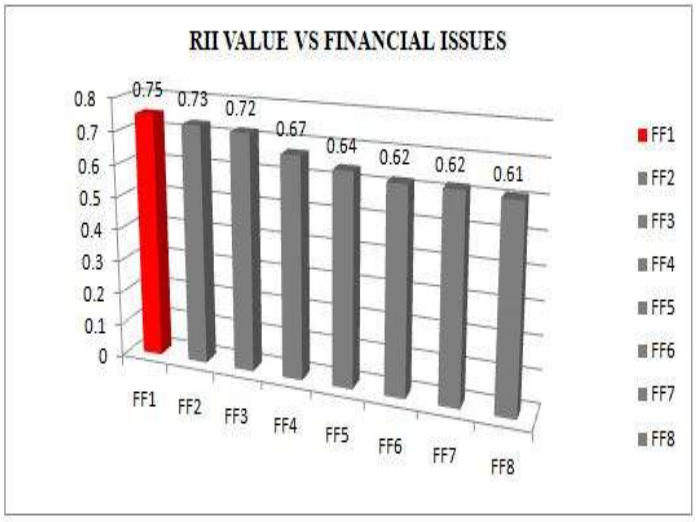

Fig. 2.4: RII value of financial issues related factors

2.2.5 Bidding Situations

The factor number BF1 that represents the factor, Number of competitors which has the highest RII Value i.e. 0.64, (shown in red color in graph) therefore, it has highest rank i.e.1

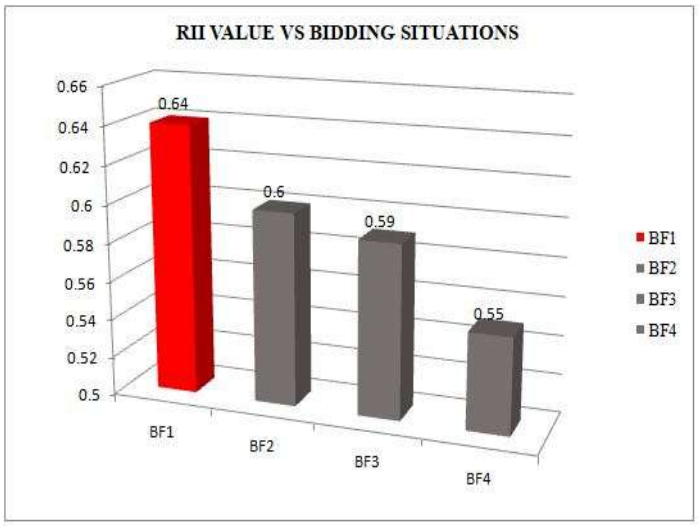

Fig. 2.5: RII value of bidding situations related factors

2.2.6 Project Characteristics

The factor number PC1 that represents the factor, Contract period which has the highest RII Value i.e. 0.68, (shown in red color in graph) therefore, it has highest rank i.e.1.

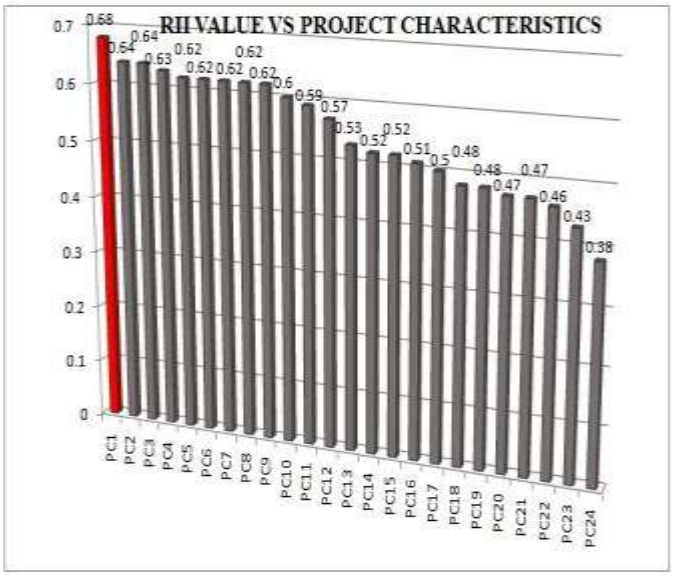

Fig.2.6: RII value of Project characteristics

2.2..7 Estimating Process

The factor number EP1 that represents the factor, Relevant experience of estimating team which has the highest RII Value i.e. 0.67 (shown in red color in graph), therefore, it has highest rank i.e.1.

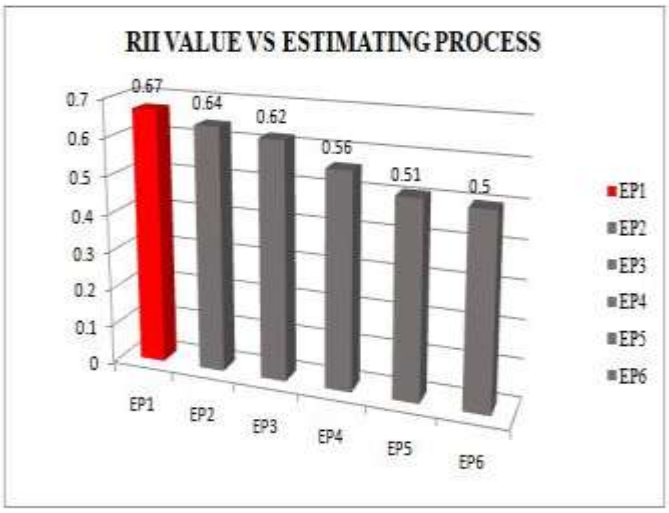

Fig.2.7: RII value of Estimating process

3.6 Ranking Result

From the above analysis first rank of Design related factor is Design complexity and construction complexity, first rank of Time/Cost related factors is Need for project to be completed within budget, first ranks of Parties experience related is Contractor's experience with similar project, Contractor track records for completion on budget and Communication among project team, first rank of Financial issue related factors is Availability of management and finance plans, first rank of Bidding situation is Level of competition, first rank of Project Characteristics related factor is contract period, first rank of Estimating related factor is Relevant experience of estimating team.

FACTORS	RII VALUE
1. Design complexity	0.81
2. Construction complexity	0.81
3. Significance for project to be completed within budget	0.87
4. Contractor's experience with similar project	0.86
5. Contractor track records for completion on budget	0.86
6. Communication among project team	0.86
7. Availability of management and finance plans	0.75
8. Level of competition	0.64
9. Contract period	0.68
10. Relevant experience of estimating team	0.67

Table 3.10 Ranking result

3.7 SPSS MODEL

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	95.0% Confidence Interval for B		Correlations		
		B	Std. Error	Beta	Lower Bound	Upper Bound	Zero-order	Partial	Part
1	(Constant)	-10.780	19.262		-57.912	36.351			
	F1	0.415	0.645	0.433	-1.163	1.994	.001	0.254	0.097
	F2	0.340	0.474	0.395	-0.821	1.501	0.075	0.280	0.108
	F22	0.517	0.502	0.528	-0.710	1.745	0.144	0.388	0.155
	F30	-0.230	0.455	-0.244	-1.344	0.884	-0.012	-0.202	-0.076
	F35	-0.066	0.302	-0.071	-0.805	0.672	-0.073	-0.089	-0.033
	F40	-0.440	0.455	-0.447	-1.553	0.672	-0.037	-0.368	-0.146
	F47	0.530	0.601	0.658	-0.940	1.999	0.038	0.339	0.133
	F59	-0.564	0.619	0.646	-0.950	2.077	0.026	0.349	0.137
	F77	-0.437	0.505	-0.472	-1.672	0.798	-0.013	-0.333	-0.130

a. Dependent Variable: F14

Fig 3.9: Regression Model Coefficients.

4. CONCLUSIONS

Studies and discussions were done on cost estimation in construction industry at various fields based on the journals collected. Eighty factors affecting cost estimation in construction fields are identified. The study indicates seven most significant factors as major contributor to cost of public building projects. Design related factors, Time or Cost related factors, Parties experience related, Financial issues, Bidding situations, Project Characteristics, Estimating Process. These amounts to seven factors and all these factors were used for the model estimation. The details regarding the topic is collected by questionnaire survey with the help of estimation engineer, site engineer, supervisor project manager, contractor and others and 86 questionnaire samples were obtained and were used for the study. The importance level and ranking of the factors were done by Likert's scale method and RII technique. Most effective questionnaire was the Likert's scale method in which each and every one can respond according to his/her will.

The research has shown that project cost depends largely on highest ranked factors such as Design complexity and Construction complexity having RII value 0.81, Significance for project to be completed within budget having RII value 0.87, Contractor track records for completion on budget, Contractor's experience with similar project and Communication among project team having RII value 0.86 Availability of management and finance plans having RII value 0.75 , Level of competition having RII value 0.64, Contract period having RII value 0.68, and Relevant experience of estimating team having RII value 0.67 .This study will be able to develop a predictive cost model using these selected factors that exhibit a significant effect on project cost and these factors accounted for the model. Further research is required for the model to be fully appreciated.

REFERENCES

[1] Afshin Firouzi, Wei Yang, and Chun-Qing.(2016), 'Prediction of Total Cost of Construction Project with Dependent Cost Items', Journal of Construction Engineering and Management, Vol. 142, No.12, pp.401-607.

[2] Amol Tatiya, Dong Zhao, Matt Syal,George H. Berghorn and Rex LaMore (2016), 'Cost prediction model for building deconstruction in urban areas', Journal of Cleaner Production, Vol. 195, No.15, pp.1572-1580.

[3] Anthony K. Mason and Alice Smith (2013), 'Cost Estimation Predictive Modelling: Regression versus Neural Network', The Engineering Economics, Vol. 42, No.2, pp.1-28.

[4] ChangYoonJi, TaeHoon Hong, and ChangTaek Hyun.(2014), 'CBR Revision Model for Improving Cost Prediction Accuracy in Multifamily Housing Projects', Journal of Management in Engineering, Vol. 26, No.4, pp.229-236.

[5] Cheong Peng Au Yong, Azlan Shah Ali and Faizah Ahmad (2013), 'Establishing relationship between Characteristics of preventive maintenance and Cost performance', RICS COBRA 2012, Vol. 11, No.13, pp.593-601.

[6] Faizah Ahmad, Cheong Peng Au-Yong and Azlan Shah Ali(2013), 'Prediction cost maintenance model of offices Building based on Condition based maintenance', Maintenance and Reliability, Vol.15, No.1, pp.309-314.

[7] Faizah Ahmad, Cheong Peng Au-Yong and Azlan Shah Ali(2014), 'Prediction cost maintenance model of offices Building based on Condition based maintenance', Maintenance and Reliabilty, Vol. 16, No.2, pp.319-324.

[8] Faiq Mohammed Sarhan Al-Zwainy and Neran Taher Hadhal (2016), 'Building a Mathematical Model for Predicting the Cost of the Communication Towers Projects Using Multifactor Linear Regression Technique', International Journal of Construction Engineering and Management,. Vol. 5 No. 1, pp. 25-29.