International Journal of Engineering and Technical Research (IJETR)
ISSN: 2321-0869, Volume-3, Issue-2, February 2015

Predictors of Project Cost Utilizing Parametric Cost Analysis of Selected Domestic Construction Projects

Efren M. Pantoja, Ria Liza C. Canlas, Bartolome T. Tanguilig III

Abstract— **The issue of the cost of construction is one that is rarely far from the minds of construction clients, design teams, constructors and of course, quantity surveyors. The cost of constructing a building project is a primary concern for the vast majority of construction clients. Using the different estimating parameters from selected Philippine domestic projects, this study determined the various factors that interplay in the project cost performance of the construction projects. Specifically, the objectives attained were profiling of selected domestic construction projects; predictors of construction project cost; and, mathematical model utilizing parametric cost analysis in estimating future project cost. This study used selected building construction projects within and adjacent to Manila. There were thirty (30) structures which were part of this study. These structures were vertical medium rise projects. Linear regression was utilized to predict the model. Findings showed that the majority of the 30 projects engaged in government projects and constructors are corporations. The positively significant indicators were Project Duration (Days), Building Perimeter (l.m), Building Volume (cu.m), Total Weight of Steel Bars (kg/s), Exterior Wall Area (sq.m) and, Volume of Excavation (cu.m). The model for predicting the project cost for medium rise projects was derived and maybe used in other projects.**

Index Terms—**Construction project cost, estimates, modeling cost, project management.**

I. Introduction

Clients are aware of what their building should cost. Indicative cost ranges for various types of development are regularly published by the larger quantity surveying practices and are also found in construction price-books. It is only natural for a client to question why their development cannot be budgeted at the lower cost of the indicative range. In these situations the QS will need to explain that the cost of construction work is influenced by a wide range of factors. These include the identity and priorities of the client, the nature of the project and the one responsible for the developing its design, the choice of procurement options, the prevailing market conditions and legislative constraints. Many of these factors are interlinked. Priorities directly influence the choice of procurement strategy and associated contractual arrangements, which regulate how the contract is to be operated and how risks are to be allocated between the contracting parties. These, in turn, impact on how the work is planned and carried out on site, and the influence on the eventual level of productivity is achieved. The aim of the quantity surveyor in this process will be to maximize the value of client's money.

Manuscript received February 18, 2015.

Efren M. Pantoja, Graduate Programs, Technological Institute of the Philippines, Quezon City, Philippines.

Ria Liza C. Canlas, Graduate Programs, Technological Institute of the Philippines, Quezon City, Philippines.

Bartolome T. Tanguilig, Graduate Programs, Technological Institute of the Philippines, Quezon City, Philippines.

II. Review of Related Literature and Studies

Poor cost performance in construction projects is a well known element in resulting huge amount of cost overrun as faced by construction industry globally. The cost overrun is very dominant in both developed and developing countries [1]. It affects both physical and economic development of the country and thus, it it important to ensure construction projects are completed within the estimated cost. Numerous worldwide researches have been conducted to understand cost performance of construction projects. Meng [2] also investigated UK construction and found that 26 (25.2%) of 103 investigated projects faced overrun, Case study conducted by Chang [3] on four projects in USA found that the entire projects facing cost overrun ranged from 12.3% to 51.3% with an average of 24.8% of the contract sum. Similarly, Zugo et al. [4] studied 92 traffic structures in Slovenia and found that the construction cost exceeded 51% of the budgeted cost.

Compared to the developed countries, the cost overrun experienced in developing countries is more serious. In India, a study on 290 projects with a contract sum of 270,568 million Indian rupees faced a total of 200,024 million Indian rupees of cost overrun where an average each project faced 73% exceeding the estimated cost as cited by [5]. In Korea, Lee [6] examined 161 projects which included 138 road projects, 16 rail projects, 2 airport, and 5 port projects. His finding indicate that 95% of road projects faced 50% cost overrun; all the rail projects also faced 50% cost overrun while 2 airports projects experienced 100% cost overrun and 5 port projects experienced about 40% cost overrun. An investigation of 137 construction projects in Nigeria found that 55% of projects faced cost overrun within the range of 5% to 808% of the project costs [7]. Northern by-pass project in Kampala, Uganda, experienced cost overrun with more than 100% while, in other study, it was found that 53% of 30 construction projects investigated faced cost overrun [8].

Construction project cost forecasting means using the past similar construction project price on bids and the variable marketing messages as the main factors, introduces a predicting model to forecast the future project cost. Empirical statistics shows that, the possibility that exactly predicting cost affected the whole project is 30% to 75%. [12-9].

Especially in last ten years, the neural network as the mainly algorithms is popularly used in such field [13-10]. This model has many obviously advantages.

Cost prediction, the basis of cost budgeting, and cost management, not only play an essential role in construction project feasibility studies, but are fundamental to a project's ultimate success [14-11,15-12,16-13,17-14]. The development and use of models, able to predict failure in advance, can be very important for the firms in two different ways. First, as forecasting systems, such models can be very useful for those (i.e. managers, authorities, etc.) who have to prevent failure. Second, such models can be useful in aiding decision-maker of construction firms in charge of evaluation and selection of the sub-contractors.

Pawlak [18-15] first introduced rough set theory. Rough set theory [18-15, 19-16] is based on the undistinguished thought and knowledge reduction method. Objects characterized by the same information are indiscernible in view of the available information. The indiscernible relation generated in this way is the mathematical basis for the rough set theory. It can be used to remove the redundant attributes affecting the project cost, greatly simplify the space dimension of project cost knowledge, depict the importance of different attributes in the expression of project cost knowledge, simplify the expression space of project cost knowledge, thus being able to quickly prepare for the prediction of the target project cost.

The term early estimate is used to describe the process of predicting a project's cost before the design of the project is completed [28-17]. The technique is used to estimate one characteristics of a system, usually its cost, from other physical and/or performance characteristics of the system [29-18]. This technique involves life cycle costs, a detailed data base, and the application of multivariable correlation [30-19].

Early cost estimating is considered as the most significant starting process to influence the fate of a new project [31-20]. The accuracy of cost estimation improves toward the end of the project due to detailed and precise information. The early or conceptualization phase if the first of a project in which the need is examined, alternatives are assessed, the goals and objectives of the project are established and a sponsor is identified due to less defined project details.

Ahuja et al. [33-22] state that estimating is the primary function of the construction industry; the accuracy of cost estimate starting from an early phase of a project through the tender estimate can affect the success or failure oa a construction project. They also state that may failures of construction projects are caused by inaccurate estimates.

A cost estimates establishes the base line of the project cost at different stages of development of the project. As Hendrickson et al [34-23] point out, a cost estimate at a given stage of project development represents a prediction provided by the cost engineer or estimator on the basis of available data. Gould [35-24] defined estimates as an appraisal, an opinion, or an approximation as to the cost of a project prior to its actual construction. According to Jelen et al [36-25] estimating is the heart of the cost engineer's work and consequently it has appropriate attention over the years.

Mahamid et al [32-21] developed multiple linear regression models for preliminary cost estimating for road construction activities as a function of project's physical characteristics such as terrain condition, ground condition and soil drill ability. He used a neutral network approach to manage construction cost data and develop a parametric cost estimating model for highway projects. They introduced two alternative techniques to train network's weights: simplex optimization (Excel's inherent solver function), and Gas (genetic algorithms).

Three costs prediction models were developed by Christian and Newton [39-26] in order to determine an accurate cost for road maintenance. These models were developed in the province of New Brunswick based on historical data during the period 1965-1994. Based on the models and the management review, it was concluded that maintenance funding needed to be increased by 25%.

Lowe et al [40-27] developed linear regression models in order to predict the construction cost of building, based on 286 sets of data collected in the United Kingdom. They identified 41 potential independent variables, and through the regression process, showed five significant influencing variables, and, through the regression process, showed five significant variables such as gross internal floor area (GIFA), function, duration, mechanical installations, and piling.

The classification of costs, the standard databases and the techniques of estimating construction costs differ in various countries [44-28]. The aim and the techniques of estimating construction costs as well as precision of the estimated price differ according to the stage of the construction project implementation.

There are several cost estimating methods, namely: traditional detailed breakdown cost estimation, average estimation per construction area, comparative cost estimation, multiple linear regression, principal component regression, and case-based reasoning (CBR) [50-29, 52-30, 53-31, 54-32, 55-33, 56-34, 57-35].

III. Methodology

A. Research Design

Descriptive method of research was used because this involved gathering data that described the results on the predictors of the future project costs such as total project cost in Philippine peso, project duration in days, total floor area in m2., average number of men, exterior wall area in m2, interior wall area in m2, volume of excavation in m3, lateral area of roof in m2, building perimeter in lineal meter, building height in lineal meter, building volume in m3, volume of concrete in m3, total weight of steel bars in kg, effective formworks area m2, and painting area m2.

B. Sampling

This study used selected building construction projects within and adjacent to Manila. There were thirty (30) structures which were part of this study. These structures are vertically medium rise projects.

The sample projects were constructed in Manila during the school year 2014-2015.

C. Research Instrument

The construction project blue prints were basically the instruments used in this study. The blue print includes the architectural plans, structural plans, electrical, mechanical and other project detail plans.

Architectural plans include the perspective, the different elevation plans, and cross-sectional plans. The structural plans includes the framing plans for each level, the foundation plan and the detailed plans such as beam design details, girder design details, foundation design details, column design details and other miscellaneous design details.

D. Data Gathering Procedure

The data gathering started with the identification of sample construction project. Quantity take off of the following construction variables follows. Then analysis and interpretation of the variables using the appropriate statistical instrument.

E. Statistical Treatment of Data

The Multiple Regression (Backward Analysis) was used in the treatment of data. It was used to test the significant indicators of predicting project cost and the mathematical model. The statistical tests used in interpreting the regression output were: standardized coefficients that determined the relative importance of the significant predictors where variables having larger absolute standardized coefficient contributes more to the model; adjusted Coefficient of Determination (adj R2) as the explanatory powers of the determinants to explain the dependent variable, t-statistic of each variable must have a significance level of equal or less than .05 to be accepted in the model and F-value must have a significance level of equal or less than .05, tests the acceptability of the model from a statistical perspective which means that the variation explained by the model is not due to chance.

IV. RESULTS AND DISCUSSION

A. Profiling of Selected Domestic Construction Projects

There were 33.33% of the selected projects that are privately owned and the remaining 66.67% is government owned, 33.33% of the companies handling the selected domestic projects are sole-proprietorship and the remaining 66.67% are corporation. Half are located in Metro Manila while the other half are outside Manila.

Projects selected were from the mall stall to a 4-storey building. With regards to the values of the identified possible indicators, the mean, minimum and maximum values for government projects, private projects and over-all were shown in Table 1. For the over-all, the following were the range: (1) The project cost range from 473,919.11PHP to 132,000,000,000PHP; (b) Project duration range from 15 days to 1256 days; (c) Total floor area from 256.74 to 142800 sq.m.; (d) Average Number of Men (No. per Day) from 8 to 390; (d) Exterior Wall Area (sq.m) from 391.50 to 28193; (e) Interior Wall Area (sq.m) from 58.35 to 97586.55; (f) Volume of Excavation (cu.m) from 20.73 to 507347.00; (g) Lateral Area of Roof (sq.m) from 20.04 to 15305.09; (h) Building Perimeter (l.m) from 32.00 to 13133.40; (i) Building Height (l.m) from 6.28 to 160.76; (j) Building Volume (cu.m) from 835.80 to 24,4415.56; (k) Volume of Concrete (cu.m) from 25.93 to 16969.09; (l) Total Weight of Steel Bars (kg/s) from 106.00 4348350.00; (m) Effective Formworks Area

Table 1 Value of Predictors

Factors	**Government Projects**			**Private Projects**			**Over-all**		
	Mean	Minimum	Maximum	Mean	Minimum	Maximum	Mean	Minimum	Maximum
Project Price (Peso)	3.76E+07	4300000	1.29E+08	3.18E+08	473919.11	1.32E+09	2.22E+08	473919.11	1.32E+09
Project Duration (Days)	214	110	360	405.3684	15	1256	339.3793	15	1256
Total Floor Area (sq.m)	1719.932	377.8	4651.86	27608.922	256.74	142800	18020.407	256.74	142800
Average Number of Men (No. per Day)	28.5714	17	59	75.8667	8	390	60.8182	8	390
Exterior Wall Area (sq.m)	2136.7386	896	4278.23	6221.8686	391.5	28193	4860.1586	391.5	28193
Interior Wall Area (sq.m)	2055.9886	200	4915.2	20260.999	58.35	97586.55	13889.246	58.35	97586.55
Volume of Excavation (cu.m)	530.724	100	1572.04	34068.618	20.73	507347	21647.176	20.73	507347
Lateral Area of Roof (sq.m)	807.6344	324.3	2275	2620.0586	20.04	15305.09	1910.8491	20.04	15305.09
Building Perimeter (l.m)	139.8844	58.56	292	1032.8387	32	13133.4	697.9808	32	13133.4
Building Height (l.m)	14.4789	6.28	24.61	36.0057	7.4	160.76	27.5822	6.28	160.76
Building Volume (cu.m)	15679.958	2370.7	54241.92	77085.773	835.8	244415.56	53057.41	835.8	244415.56
Volume of Concrete (cu.m)	678.135	148.6	1485.87	5222.5831	25.93	16969.09	3474.7185	25.93	16969.09
Total Weight of Steel Bars (kg/s)	95506.337	106	280738.54	827763.9	271.21	4348350	546126.38	106	4348350
Effective Formworks Area (sq.m)	3957.2175	1040	10431.05	23990.688	478	105935	18266.839	478	105935
Painting Area (sq.m)	5390.4222	1900	10473.46	23961.363	8	143657	16997.26	8	143657

(sq.m) from 478.00 to 105935.00; and, (n) Painting Area (sq.m) from 8.00 to143657.00.

Predictors of Construction Project Cost

B. Predictors of Construction Project Cost

The determination of the predictors of cost using parametric method of cost analysis was done by regression. It has to be noted that the possible indicators considered are factors that are easily computed from plans and some derived rough estimation methods. There were 14 possible indicators of project cost considered.

1) Regressing the Project Cost on the Indicators.

This method was employed to determine the significant effect of possible indicators used (as independent variable) to the project cost (as the dependent variable).

Table 2 Regression of Compressive Strength at 28th day for Change on the Major Components of PO-LITE

MODEL	STANDARDIZED COEFFICIENTS	T	SIG.
	BETA		
(CONSTANT)		-1.831	.080
Project Duration (Days)	.389	3.055	.006
Exterior Wall Area (sq.m)	-.440	-3.392	.003
Volume of Excavation (cu.m)	-1.359	-2.074	.049
Building Perimeter (l.m)	1.458	2.206	.038
Building Volume (cu.m)	.471	4.028	.001
Total Weight of	.574	3.682	.001

Adjusted R-square = .902
F Value = 45.421
Significance = .000

The positively related significant indicators are: Project Duration (Days); Building Perimeter (l.m); Building Volume (cu.m); and, Total Weight of Steel Bars (kg/s). The positive relationship established simply implies that as these values increases, the cost likewise increases.

The negatively related significant indicators are: Exterior Wall Area (sq.m); and, Volume of Excavation (cu.m). The negative relationship simply indicates that as these indicators increase in values, the cost becomes lower.

It could be interpreted that the positive and negative relationships turned out to be in the said relationships simply to balance the cost when all the significant indicators were included in the mathematical model. It has to be noted that building perimeter and building volume are not normally considered in the conventional estimating extension; therefore, having those indicators included in this model may mean adjustments on the values of those negatively related indicators.

These indicators explain the compressive potential as indicated by the adjusted R square of 90.2% with F-value of 45.421 at .000 significance.

The ANOVA analysis in regression tests the acceptability of the model from a statistical perspective. The significance value of the F=45.421 significant at .000 is less than 0.05, which means that the variation explained by the model is not due to chance.

Adjusted R Square= .902 which was computed from the coefficient of determination, the squared value of the multiple correlation coefficient. It shows that about 90.2% of the variation in the dependent variable is explained by the model. The remaining 9.8% comprises other variables not considered in this model.

The t-statistics for each determinant exceeded the study's significance level of $\alpha = .05$, therefore the individual variables were significant.

Referring on the derived Standardized coefficients, the top contributor to the model was Building Volume (cu.m) followed by Total Weight of Steel Bars (kg/s).

2) Mathematical Model Utilizing Parametric Cost Analysis in Estimating Future Project Cost

Based on the results of the regression analysis, from the 145 possible indicators, only 6 turned out to be significant. From here, the mathematical model arrived in estimating future project cost.

The general formula is expressed as:

$$y = c + a_1x_1 + a_2x_2 + a_3x_3 + a_4x_4 + a_5x_5 + a_6x_6$$

Where, y is predicted project cost, c is constant, a_n are standardized coefficients, and x_n are values of indicators from rough estimation.

Applying the general equation, the mathematical model in order to estimate the project cost in a much faster way than detailed estimating is written below.

$$y = -1.831 + 0.39x_1 -.0440x_2 - 1.359\ x_3 + 1.458x_4 + 0.471x_5 + 0.574x_6$$

Where, y is the predicted project cost, x_1 is Project Duration (Days), x_2 is Exterior Wall Area (sq.m), x_3 is Volume of Excavation (cu.m), x_4 = Building Perimeter (l.m), x_5 is Building Volume (cu.m), and, x_6 is Total Weight of Steel Bars (kg/s).

The said model can be applied in any medium rise projects.

V. Conclusion and Recommendations

Based on the findings the following conclusions were derived:

1. The majority of the 30 projects are corporation and are engaged in government projects.
2. The positively related significant indicators are: Project Duration (Days); Building Perimeter (l.m); Building Volume (cu.m); and, Total Weight of Steel Bars (kg/s). While the negatively related significant indicators are: Exterior Wall Area (sq.m); and, Volume of Excavation (cu.m).
3. The model for predicting the project cost for medium rise projects were derived and maybe used for other projects

Since there is still about 10% unexplained component in the model, other variables may still be added in the analysis for a better model. Relationships on the cost between profile can also be determined. It is recommended to utilize this model for other projects.

ACKNOWLEDGMENT

The researcher is thankful to Engr. Ria Liza C. Canlas, as my adviser and mentor.

REFERENCES

[1] W.J. Angelo and P. Reina, "Megaprojects need more study up front to avoid cost overruns," 2007, http"//flyvbjerg.plan.aau.dk/News%20in20English/ENR%20Costlies%20150702.pdf.
[2] X Meng, "The effect of relationship management on project performance in construction," International journal of Project management, vol. 30, no. 2, pp. 188-198, 2012
[3] A.S.-T. Chang, "Reasons for cost and schedule increase for engineering design projects," Journal of Management in Engineering, vol. 18, no. 1, pp. 29-36, 2002.
[4] V. Zujo, D. Car.-Pusic, and A. Brkan-Vejzovic, "Contracted price overrun as contracted construction time overrun function," Technical Gazette, vol. 17, no. 1, pp. 23-29, 2010
[5] N. Gupta, "avoiding time and cost overruns in the construction of Rohtang tunnel," 2009, http://www.idsa.in/idsacomments/AvoidingTimeandCostOverrunsintheConstructionofRohtangTUnnel.ngupta.141209
[6] J.-K. Lee, "Cost overrun and cause in Korea social overhead capital projects: roads, rails, airports, and ports," Journal of Urban Planning and Development, vol. 134, no. 2, pp. 59-62, 2008
[7] O.A. Olatunji, "A comparative analysis of tender sums and final costs of public construction and supply projects in Nigeria," Journal of Financial Management of Property and Construction, vol. 13, no. 1, pp. 60-79, 2008.
[8] R. Apolot, H. Alinaitwe, and D. Tindiwensi, "An investigation into the causes of delay and cost overrun in Uganda's public sector construction projects," in Proceedings of the 2nd International Conference on Advances in Engineering and Technology, pp. 305-311, 2008vol. 2, Aug. 1987, pp. 740–741 [*Dig. 9th Annu. Conf. Magnetics* Japan, 1982, p. 301].
[9] Jian Gong, "Whole Course Management of Cost of Construction Project", Coal Technology, Beijing, Mar. 2007, pp 1-2.
[10] Qiang Chen and Mingyan Zhai, "Study on the Model of Cost Estimation of Construction Based on the BP Neural Network', Optimization of Capital Construction, Beijing, Jun. 2002, pp. 1-2.
[11] Min-Yuan Cheng, Hsing-Chih Tsai, Wen-Shan Hsieh. Web based conceptual cost estimates for construction projects using Evolutionary Fuzzy Neural Inference Model [J]. Automation in Construction. 2008, 8
[12] Wen-der Yu, Chien-chung Lai and Wan-Li Lee. A WICE approach to real time construction cost estimation [J]
[13] Wang Zu-he, Yang Yi. Dynamic construction project cost estimation system [J]. Journal of project management. 2003, I. 75-78 (in Chinese)
[14] S.W. Moon, J.S. Kim and K.N. Kwon. Effectiveness of OLAP-based cost data management in construction cost estimate [J]. 2008
[15] Z. Pawlak. Rough Sets-Theoretical Aspects of Reasoning about data [M]. Klystron Academic Publisher, 1994.
[16] L. Polkowski, A. Skowron. Rough Sets: A Perspective Rough Sets in Knowledge Discovery (1,2), Physica-Verlag, Heidelberg, 1998.
[17] Sanders, S.R.; Maxwell, R.R.; and Glagola, C.R. (1992) 'Preliminary estimating models for infrastructure projects', Cost Engineering, 34 (8)
[18] Rose, A. (1982) 'An organized approach to parametric estimating', Transactions of the seventh international Cost Engineering Congress. London, England
[19] Black, J. (1984) Application of parametric estimating to cost engineering, AACE Transaction, B.10.1.5.
[20] Sodikov, Jamshid (2005) 'Cost estimation of highway projects in developing country: Artificial neural network approach', Journal of the eastern Asia Society for Transportation Studies, 6, 1036-1047
[21] Mahamid, I. and Amund, A. (2010) 'Analysis of cost diverge in road construction projects' Proceedings of the 2010 Annual Conference of the Canadian Society for Civil Engineering, 9-12 June 2010, Winnipeg, Manitoba, Canada
[22] Ahuja, H., Dozzi, S., and Abourisk, S. (1944) Project Management Techniques in Planning and Controlling Construction Projects. John Wiley and Sons, Inc., New York
[23] Hendrickson, Chris and Au, Tung (1989) Project Management for Construction: Fundamental Concepts for Owners, Engineers, Architects, and Builders, 1st Edition, Prentice Hall, London
[24] Gould, F. (2005) managing the construction process: estimating, scheduling, and project control, Pearson education, Inc., new Jersey
[25] Jelen, F. and Black, J. (1983) Cost and Optimization engineering, 2nd edition, McGraw-Hill, New York
[26] Christian, J. and Newton, L. (1998) Highway construction and maintenance costs. Construction Engineering and Management Group. University of Brunswick, Frederiction, NB E3B 5A3, Canada.
[27] Lowe, D.J., Emsley, M.W., and Harding, A. (2006) 'Predicting construction cost using multiple regression techniques', Journal of construction Engineering and Management, 132 (7), 750-758
[28] Oswald, Philip F., 2001, Construction Cost Analysis and Estimating, 2001, 462 p.
[29] Han, K.H. et.al., (2008) Cost Estimation Methodology Using Database Layer in Construction Projects, The 25th International Symposium on Automation and Robotics in Construction, June 26-29, 2008.
[30] Manorasert, S., (1998). A Study on Building Construction Cost Estimation Using Work Quantity Model Approach, Thesis, Faculty of Engineering, Chulalongkorn university, Bangkok, Thailand.
[31] Arafa, M. And Alqedra, M. (2011) "early stage cost estimation of building construction projects using artificial neural networks", Journal of Artificial Intelligence, Volume 4(1): 63-75.
[32] Gunaydin, H. And Dogan, S. (2004) "A neural network approach for early cost estimation of structural systems of building", International Journal of Project Management, Volume (22): 595-602.
[33] Chan, S. and Park, M., "Project cost estimation using principal component regression", Construction Management and Economics, Volume (23):295-304.
[34] Kim, G.H., An, S., Kang K. (2004) "Comparison of Construction Cost Estimating Models Based on Regression Analysis, Neural Networks, and Case-Based Reasoning", Journal of Building and Environment Volume (39): 1235-1242.
[35] Kim, D.Y. (2008) Two staged early cost estimation foe highway construction projects. The 25th International Symposium on Automation of Robotics in Construction, June 26-29, 2008.

Efren M. Pantoja graduated with the degree of Bachelor of Science in Civil Engineering at Luzonian University Foundation, Lucena City, Philippines in 1973. He is currently finishing his Master of Engineering program at Technological Institute of the Philippines, Quezon City, Philippines. Presently, he holds a position as Vice President for Engineering at one of the Construction Companies in Manila, Philippines. Prior to that, he has worked and served as consultant through an overseas job from 1981 up to 2007 in variety of international companies in Saudi Arabia, Iraq, Kuwait and New Zealand.

Engr. Pantoja is a member of the Philippine Institute of Civil Engineers (PICE), Registered Civil Engineer under Professional Regulation Commission (PRC), Manila, Philippines, Associate members of the American Society of Civil Engineer (ASCE), Reston VA, USA and Registered Engineering Associates (REA), The Engineering Associates Registration Board, Wellington, New Zealand.

Ria Liza C. Canlas took her Bachelor of Science in Civil Engineering at Mapua Institute of Technology, Manila, Philippines. She finished her Master of Engineering Management with specialization in Construction Management from the Pamantasan ng Lungsod ng Maynila, Manila, Philippines. She is finishing her Doctor of Technology program at the Technological University of the Philippines, Manila, Philippines.

Engr. Canlas is a Registered Civil Engineer and a Registered Patent Agent under the Intellectual Property Office of the Philippines (IPOPHIL). She is presently affiliated with Lyceum of the Philippines University (LPU) College of Engineering and Innovation and Technology Support Office (ITSO). She is the project leader of LPU Institutional Program on Research for a Sustainable Urban-Renewed Environment (ReASURE), LPU Multi-National Research Cooperation Program, LPU's product development projects, and Quality Circle for Research of College of Engineering. She is working as a consultant for Strategic Research and Development, Inc. (STRAND, Inc.). She is the principal RAM-FSIP Business Solutions and CACTech Construction.

She had researches published and several completed studies including Grant-in-aid (GIA) studies funded by the Commission on Higher Education (CHED) and Department of Science and Technology (DOST).

Bartolome T. Tanguilig III took his Bachelor of Science in Computer Engineering at Pamantasan ng Lungsod ng Maynila, Philippines in 1991. He finished his Master's Degree in Computer Science from De La Salle University, Manila, Philippines in 1999, and his Doctor of Philosophy in Technology Management from Technological University of the Philippines, Manila in 2003. He is currently the Assistant Vice President for Academic Affairs and concurrent Dean of the College of Information Technology Education and Graduate Programs of the Technological Institute of the Philippines, Quezon City.

Dr. Tanguilig III is a member of the Commission on Higher Education (CHED) Technical Panel for IT Education (TPITE), the chair of the CHED Technical Committee for IT (TCIT), the founder of Junior Philippine ITE Researchers (JUPITER), board member of the Philippine Society of IT Educators (PSITE), member of the PCS Information and Computing Accreditation Board (PICAB), member of the Computing Society of the Philippines (CSP), and a program evaluator/accreditor of the Philippine Association of College and Universities Commission on Accreditation (PACUCOA).