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Study on Cost Estimation of G+2 and Model of Mid Rise Green Office Buildings

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ABSTRACT: This study is completely to understand the cost of G+2 and green buildings to the owners. In any construction project, the probable cost of construction which is known beforehand is known as the estimated cost. The structural aspects considered for the estimation of quantities are earthwork in excavation and backfilling, concrete work in foundation and in R.C.C structures such as beams, columns, slabs, staircases etc., steel reinforcement in beams, columns and other R.C.C structures and brickwork in superstructure. In the present scenario the green building has grown in the Indian market as well as North American markets. In the construction cost of green office buildings gives impact on the life cycle. To understand building costs to building owners, a linear regression model (LRM) has introduced to understand the initial cost on structural members and materials to be used. It simplifies material combinations to use in the construction in a sustainable manner, such as steel, concrete, bricks, cork and recycled plastic. This model study gives detail estimate of cost per square foot of mid-rise office buildings, according to specified predictor parameters such as building structural system, number of floors, total floor area, and floor height. In this process of study came to know that in three main stages: 1. Preliminary quality diagnostics of gathered data (PQDGD), 2. Model development (MD) and 3. Model testing and validation (MTV). This process of study gives a new ideology to think building owners in an economic point of view.

KEYWORDS: G+2, Greenbuilding, linear regression model, mid-rise office building and materials.

I. INTRODUCTION

In building engineering services are important elements. They include electric light and power, gas services, space heating, ventilation systems, evaporative cooling, air-conditioning, water supply, fire protection, communication systems, transportation systems (e.g. lift and escalators), sanitary plumbing, sanitary fixtures and special services (which may include lighting protection and security systems) [1]. Cost estimation in project management is the process of forecasting the cost and other resources needed to complete a project within a defined scope. A cost estimation account for each element required for the project and calculates a total amount that determines a project's budget. An estimate is defined, as computation or calculation of the required quantities of finished items of work and its expenses (cost) likely to be incurred for its construction. The main object of estimate is to know the



required quantity of material, labour and cost before actual execution .It helps an engineer to plan the construction work, for quick and proper construction with required quality. The construction projects sector is one of the most vulnerable to changing circumstances because it is directly related to changing social , Economic and cultural conditions , and The construction projects are based on three pillars : cost, quality and time, so the success of any project is based on these pillars. The project is considered successful if it constructed with the highest quality, the lowest time and the lowest cost, hence, the success of the project is closely related to the cost estimate of the project.This study follows the objectives in construction purpose 1.To know the quantities of various items of work, a material and labour and their source of identification. 2.To calculate the cost of G+2 building. 3.To calculate project cost by using Long wall and short wall method. 4.To calculate cost estimates for earth work excavation. 5.To invite tenders or quotations based on the estimate quantities for entrust of works to the execution.

II. METHODOLOGY

In construction cost of estimation data are first appeared for green mid-rise office buildings in North America (the United States and Canada)In this study refers that Green building has all systems, components, and materials. In green buildings, the design has given some principles such as high-efficiency cooling, heating, electrical, plumbing, photovoltaic panels, green roofs, wind power, and high-performance walls and glazing systems[2].The description possibilities of each parameter include in Table1.

S.No	Green Office Building	
1	Building area	1000 sqft to 15000 sqft
2	Number of floors	2 to 4 floors
3	Floor height	5ft to 8ft
4	Structural system	Green Concrete frame (GCF) and Green Steel frame (GSF)
5	Envelope type	Precast concrete panel (PCP) and Cavity wall (CW)
6	Location	Warangal
7	Year of prediction	2021

Table:1 Possibilities parameter followed in Green Office Building



Figure:1 Green office building

Construction Cost at initial stage to get idea to the building owner=Substructure Cost +Superstructure Cost + Services Cost + Interiors Cost+ Equipment Cost + Architecture Fee + Contractor Fee[3].

where:

1. Superstructure: Roof construction, floor construction, exterior walls, etc.
2. Substructure: Basement excavation and walls, foundations, and slab on grade.
3. Equipment: Institutional equipment, HVAC, and other equipment.
4. Architecture fees: Planning, design, supervision, specifications and drawings, etc.



5. Services: Plumbing fixtures, elevators and lifts, water drainage, water distribution, etc.
6. Interiors: Floor finishes, partitions, ceiling finishes, wall finishes, fittings, etc.
7. Contractor fees: Direct and indirect costs, general conditions, profits and contingency, etc.

In construction the initial cost data are based on the parameters in order to respond the relationship between the predictor and dependent in a network mode. Gathering materials used for construction purpose[4]. The cost data for green mid-rise office building is categorized based on pre-identified parametric factors, such involved in the construction, as shown in Table:1.

III. PREPARATION OF DATA

The input parameters used in initial construction cost are gathered from various green office building projects in North America. Study of samples gathered data for different buildings is presented in Table 2[4].In these parameters, studied the year of construction and location. The structural system and wall systems in building are become normalized in any environmental conditions and adjusted to prepare them for modeling purpose. Other predictor variables, including structural system, envelope type, number of floors, total floor area, and floor height, are proved to have a significant correlation with the dependent variable (construction cost).

Table:2 Study of sample’s gathered data for different buildings in different cities.

Location City	Cost Index	Floor Height	Building Area (ft ²)	No. of Floor	Structure Type	Wall Type	Cost (\$/ft ²)
New York	132.1	14	250,000	8	Steel	Masonry	216.4
San Francisco	129.1	12	50,000	10	Steel	Masonry	268.3
Chicago	120.5	14	200,000	5	Steel	Precast	190.4
Philadelphia	115.0	14	350,000	5	Steel	Precast	179.4
Los Angeles	112.8	12	100,000	6	Steel	Precast	193.2
San Diego	109.1	18	250,000	8	Steel	Precast	187.4
Phoenix	88.4	16	100,000	10	Steel	Precast	175.9
Dallas	85.4	18	250,000	5	Concrete	Masonry	135.8
Houston	85.0	16	100,000	6	Concrete	Masonry	146.9
Toronto	110.1	14	150,000	8	Concrete	Precast	189.7
San Antonio	83.2	14	250,000	8	Concrete	Precast	136.8
New York	132.1	12	50,000	10	Concrete	Precast	284.5
Toronto	110.1	12	100,000	10	Concrete	Precast	202.8

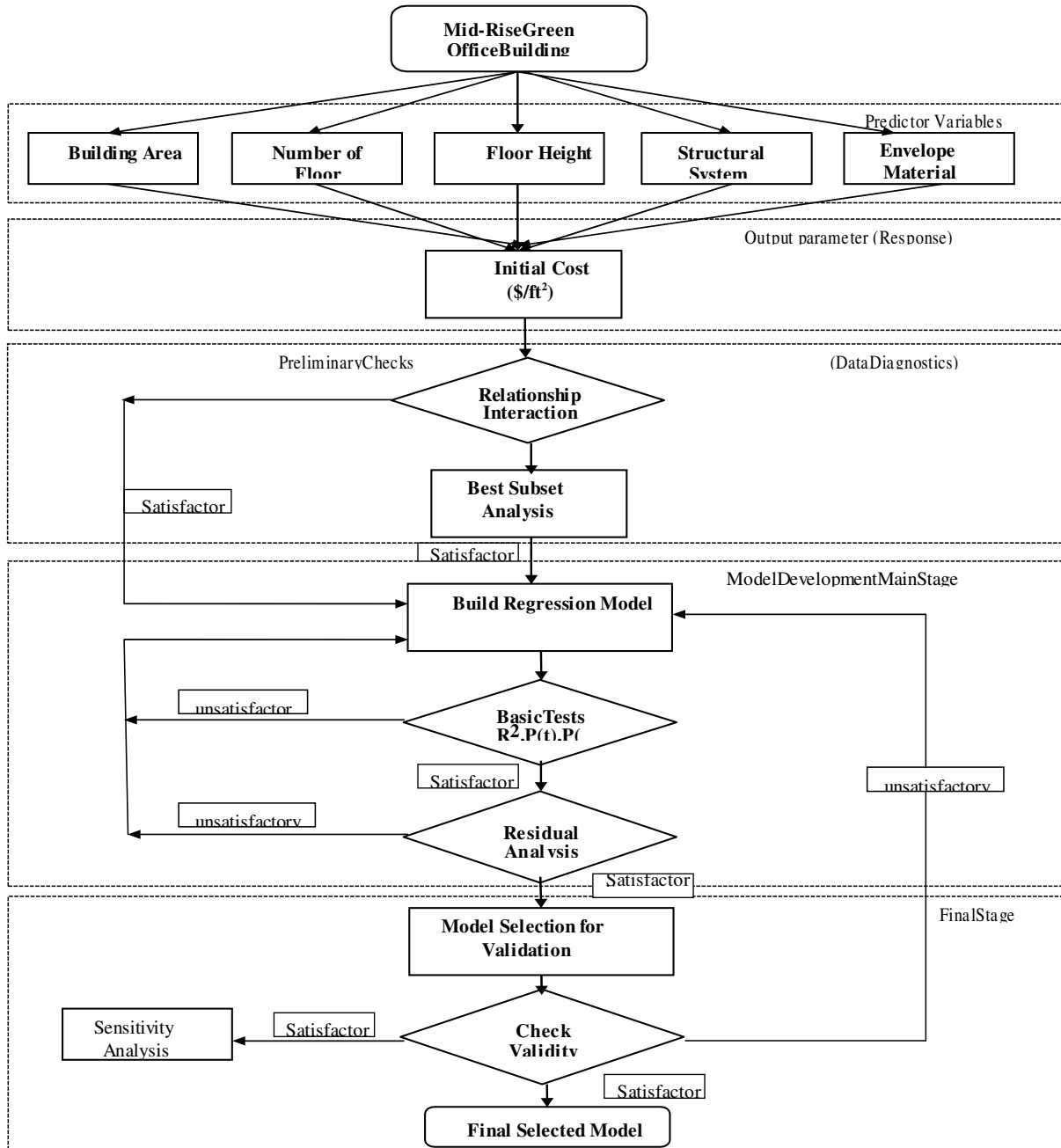


Figure:2 Development of Regression model

Study of data checked at preliminary stage

To determine any correlation, interaction or interrelationship in the predictor variables in the regression model in mid rise building, the preliminary data studies are conducted to detect and address any existing building. The most suitable of the developed models can be used to determine and selected for testing with the specified combination and number of variables[5].

Regression model in a multiple manner

Identification by study of most suitable subset of data and detecting any correlations within the dataset, a multiple regression model (MRM) is developed by employing Minitab-Software (MS). The model is developed to enable office building owners and decision-makers to forecast the initial costs of proposed green office buildings with different combinations of structural system and envelope materials. The model is built to be as representative as possible of the gathered data and is designed for ease of use by decision-makers and building owners. Microsoft Excel is employed in this stage to store the gathered data and prepare it for regression model development. The data for the predictor variables and corresponding cost values are then installed in Minitab to perform the regression analysis. The resulting outputs from Minitab include the developed regression model equations, along with the estimation of the regression coefficients " β_k " for the tested gathered data [6].

IV. MODEL TRAINING RESULT

A theoretical case study is selected to train the developed multiple-linear regression model (MLRM) for green office buildings in North America. The aim of this training is to assist the model owners to estimate the initial construction cost of a proposed green building and to compare the costs of different combinations of tested structural systems and building envelope type. This training makes the model more robust as a decision support tool for selecting the best alternative from an economic point of view. Study analysis of author Othman Subhi Alshamrani, his results and study about mid-rise buildings is very much predicted and theoretical case study show that the initial construction cost of the various green structural systems and envelope materials tested ranges from \$190.50 to 194.50 USD per sqft in North America. The lowest total initial cost is predicted for green concrete frame with cavity wall (GCM) (\$28.57 million), while the highest total initial cost is predicted for green steel frame with precast concrete panel (GSP) (\$29.17 million). No significant difference is observed when applying both the green concrete frame with precast panel (GCP) and the green steel frame with cavity wall (GSM). Moreover, the most attractive alternative in this case study is found to be GCM. This finding allows the building owner to save up to 600,000 USD compared to the most expensive alternative (GSP). One of the limitations of this study has to do with applying the multiple-linear regression technique to develop the forecasting model. The model is developed based on a limited amount of data and can be used only for North American cities and for mid-rise green office buildings ranging in size from 5 to 10 floors. The model is also limited to two structural system steel and concrete frame and two wall system masonry and precast concrete panel. Another limitation is that it only considers floor heights ranging from 12 to 18 ft and gross areas ranging between 50,000 and 350,000 sq ft. It is also limited to investigating the correlation between parameters (predictors) and predicted total initial construction costs [12].

V. CONCLUSION

Study report from green building, the most of building owners are like to be acknowledge the environmental, social, and economic benefits of green building, one prevalent misconception is that the initial construction cost is very high for green buildings compared to conventional buildings. Green building costs are still not well understood by building owners, and the literature shows a lack of cost estimate models for this purpose [7]. Hence, this study seeks to bridge the gap in the literature and contribute to the body of knowledge by developing a cost forecasting model for green buildings in terms of their structural and envelope systems. A multilinear regression method is proven to be suitable and best fitted the gathered data, and is used to develop, test, and validate a model to predict the initial construction cost of mid-rise green office buildings in the North American market. The developed mathematical equation model can be easily applied by building owners and decision-makers to assist them in predicting the cost of their buildings, comparing them to conventional, and then selecting the most attractive options of green structural frame and envelope materials for mid-rise office buildings based on economic performance [8]. All of the predictor variables are proven to have a significant correlation to the predicted costs. All of the gathered costs are adjusted, modeled, and then predicted according to the cost index for the year 2019, and conducted based on the national average costs [9]. The model is then tested and validated using mathematical and graphical validation and is found to have acceptable accuracy. Furthermore, the model offers flexibility for predicting construction cost for all cities in North America and all periods of time, since it incorporates the city index and time index, respectively. Therefore, the developed regression model could be used as a tool to predict the cost of green office buildings. Future work could extend the current research on green buildings to cover different types of structural and envelope systems, other types of buildings, and different countries [10]. It could also be extended to apply different modeling techniques on green buildings, such as NN,



genetic algorithm, fuzzy logic, and hybrid techniques. Finally, it can be extended to find the correlations among parameters rather than the total cost and to predict the cost of subcategories rather than the total initial cost [11]. In this the cost estimation of G+2 buildings is carried out. In these days Suitable cost estimation methods for buildings are necessary. It would be helpful to the managers, if a cost estimation method is developed with minimum prediction error in the estimated value.

From this study it was concluded that

1. The cost estimation was carried out for G+2 East facing building which is consisting of East facing site.
2. The cost estimation is determined by using long short wall and short wall method.
3. The total amount required for the project is obtained as 30,70,256 Rupees in total.

REFERENCES

- [1] Aibinu, A. A., D. Dassanayake, T. Chan, and R. Thangaraj. 2015. "Cost Estimation for Electric Light and Power Elements during Building Design: A Neural Network Approach."
- [2] Engineering, Construction and Architectural Management 22 (2): 190–213. doi:10.1108/ECAM-01-2014-0010.
- [3] Alshaibani, A., and O. Alshamrani. 2016. "Artificial Neural Network Based Model for Estimating Construction Cost of Mosque Build." In KSA proceedings of the first international conference on mosque architecture (pp. 77–90), Dammam, Saudi Arabia.
- [4] Alshamrani, O. S. 2017. "Construction Cost Prediction Model for Conventional and Sustainable College Buildings in North America." Journal of Taibah University for Science 11 (2): 315–323. doi:10.1016/j.jtusci.2016.01.004.
- [5] Alshibani, A., O. Alshamrani, and M. E. Shaawat. 2018. Model for Estimating Construction Costs for Low-rise Residential Buildings, 221–231. WIT. doi:10.2495/UG180211.
- [6] An, S.-H., G.-H. Kim, and K.-I. Kang. 2007. "A Case-based Reasoning Cost Estimating Model Using Experience by Analytic Hierarchy Process." Building and Environment 42(7): 2573–2579. doi:10.1016/j.buildenv.2006.06.007.
- [7] Bala, K., S. A. Mustani, and B. S. Waziri. 2014. "A Computer-based Cost Prediction Model for Institutional Building Projects in Nigeria." Journal of Engineering, Design and Technology 12 (4): 518–529.
- [8] Cheng, M. Y., H. C. Tsai, and W. S. Hsieh. 2009. "Web-based Conceptual Cost Estimates for Construction Projects Using Evolutionary Fuzzy Neural Inference Model." Automation in Construction 18 (2): 164–172. doi:10.1016/j.autcon.2008.07.001.
- [9] Cheng, M.-Y., H.-C. Tsai, and E. Sudjono. 2010. "Conceptual Cost Estimates Using Evolutionary Fuzzy Hybrid Neural Network for Projects in Construction Industry." Expert Systems with Applications 37 (6): 4224–4231. doi:10.1016/j.eswa.2009.11.080.
- [10] Hong, T., C. Hyun, and H. Moon. 2011. "CBR-based Cost Prediction model-II of the Design Phase for Multi-family Housing Projects." Expert Systems with Applications 38 (3): 2797–2808. doi:10.1016/j.eswa.2010.08.071.
- [11] Ji, S.-H., M. Park, and H.-S. Lee. 2011. "Cost Estimation Model for Building Projects Using Case-based Reasoning." Canadian Journal of Civil Engineering 38 (5): 570–581. doi:10.1139/11-016.
- [12] Othman Subhi Alshamrani 2020. "Othman Subhi Alshamrani (2020): Initial cost forecasting model of midrise green office buildings, Journal of Asian Architecture and Building Engineering, DOI:0.1080/13467581.2020.1778005.



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