Journal of Advances and Scholarly Researches in Allied Education
Vol. 20, Issue No. 2, April-2023, ISSN 2230-7540

Development of a Prediction Model for Construction Project Cost in India: an Analytical Approach

Shivani Kankate*

JSPM'S Pune

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 . Construction prices are always prone to fluctuations, with a long-term pattern of increasing, making the pricing process a difficult task. Fluctuations in the cost of building materials have a significant impact on predicting the value of a project and, as a result, on the project's good conclusion. The price difference has an impact on project execution costs and, as a result, on the projects' ability to be completed. Cement and steel price prediction is taken as one objective of this research. For this, relevant resource data between 2015 and 2020 was collected The price volatility of cement and other construction materials during the project period is one of the primary elements affecting the construction industry's performance. They are compared in terms of performance cross the country. Multiple regression analysis, trend analysis, and artificial neural networks prediction approaches used in the construction sector are used to predict the material price. In this Paper also awareness regarding predication model for predication cost in construction industry also examine.

Keywords - Cost Predication, Cement Consumption, Prize

----------X----------

INTRODUCTION

Cost prediction is a vital process for every business in that it is a predecessor for budget prices and resource allocation in a project life cycle. Actually, it is hard to obtain input data for cost estimation process, while the scope of work is barely known in that it might lead to poor and rough estimates. The more, the project scope is known there are more chances to generate estimates that are more accurate in that more specifications of the project are defined. However, it should be taken into account that, on the other hand, by the progressive elaboration, the process of cost control becomes more difficult if the project is based on inaccurate cost estimates. Furthermore, construction industry due to its characteristics and large amounts of capital needed to initiate and continue the project, are the project types which need more attention because they are high-risk Either overestimating or underestimating the cost of these projects will lead to future deviations in budget vs. realized cost. Hence, the methods used in this realm, their respective accuracy, and even their gaps have shown growing interest. Methods with more consistent. results can facilitate and smooth the path for cost estimators provided that their related gaps can be investigated and overcome in order to acquire better results. In conventional methods, by knowing work packages and their prices and how they are distributed along the project lifetime; the total project cost can be estimated. an estimated amount of reserve.

Role of Construction Cost Prediction

Cost estimators can benefit from methods that produce more reliable results if their associated differences can be explored and resolved to achieve better results. Using traditional approaches, the overall project cost can be calculated by understanding job packages, their costs, and how they are allocated over the project's lifespan, . This will be used as a basis for allocating project resources and calculating future budgets. The traditional approaches have shown that they are inadequate. As a result, the lack of a comprehensive approach to reducing estimation error has resulted in experiments that have attempted to solve incorrect or even erroneous forecasts using statistical formulas, machine learning methods, and other methods. The projected project construction cost varies from the tender price in where the tender price covers extra items such as business benefits and contingency funds. The sum allocated to identified threats during project implementation, which is an approximate amount of reserve, is referred to as the contingency fund.

TOOLS USED OF CONSTRUCTION COST PREDICTION

Artificial Neural Network (ANN) and Regression analysis (RA), amongst the multiple methodologies respectively (ANN, Fuzzy NN, Support Vector Machine (SVM), Particle Swarm Optimization (PSO), Radial Basis Function (RBF), RA, Logistic Regression, Analytic Hierarchy Process (AHP), Monte-Carlo, fuzzy logic) are the most common machine learning technologies used in the reviewed papers, . ANN and RA are the most popular and simplestmethodologies in these studies in comparison to other types. However, hybrid models incorporating ANN with the theory of probabilities, Genetic Algorithm (GA), and other techniques alone surpassed ANN. A thing to consider is the high sensitivity of an ANN implementation to input data.

Given that this data science method is based on data, many devices, and a homogeneous data set from which the relationships between the data available will work better. On the other hand, several available neurons (also known as the cost factors) directly affect device failure. Asthat the number of required cost variables increases the complexity of the system increases, and the accuracy of the results decreases in the case of the cost estimate for the construction.

According to this research, the percentage of hidden neurons and their weights have a significant impact on the overall capacity of the model. Rather than significant observation, the number of factors affects the predictive performance of the estimate directly.

ANN is also a well-known framework for handling complex equations. Many experimental studies have struggled with adjusting ANN parameters like variables of the hidden layer and weights but have been solved with the GA algorithm. Nonetheless, expert expertisein selecting cost variables in modeling techniques has a significant impact. Furthermore, in cost assessment reports, the construction and highway programs receive the most attention from the researchers,

Importance of Awarness for Predictions of Construction Cost

Budgets aren't the priority for businesses considering expansion. Regardless, they will settle at budgets at some stage during the project's preparation, which is a vital step. Any project's progress depends on having a realistic budget. As a result, the organization must decide if its budget limit is appropriate to realize its goals. However, without a reliable and very well development estimate, this vision will not be realized. Clients would still have to evaluate bids by construction firms; as a result, each firm must address their estimated project costs as well as the length of the project.

The client chooses the best-suited company to complete the project afterconsidering bids. Contractors can employ estimators in-house or hire project estimators on the outside. The most critical aspect is that the estimator is competent, they should be able to closely analyze blueprints and schematics, collect information about the project, and accurately estimate project length, materials, and labor. Clients and other project stakeholders need to realize that projections are likely to modification. Simply put, projections are an integral part of the construction process, but they may be influenced by unexpected circumstances. Weather adjustments and market value volatility, for example, may cause a project to be delayed or over budget.

One of the most feasible conditions for clients to employ construction firms in construction estimation. The calculation must be as consistent as possible, as well as the estimator must remain on the job for the length of the project. As projects surpass the cost of the estimate, clients are often required to cover extra expenses or forego certain designs to remain within the budget. When it comes to evaluating contractor bids, time is of the essence. The track record of a construction firm will assist you in making decisions.

Concluding Remark

Projectors and researchers have an issue with predicting the length of acceptable building projects. This problem is solved by several researchers and methods. The analysis aims to estimate the length of the construction using four analytical methods. The performance of building project deliverables depends on multiple parameters including contractor selection, consultancy, project costs, project efficiency, the number of projects, environmental considerations, etc. Commercial resources currently commercially available are not planned as standard and widely concerned. In one situation each method works well. The main problem, for many reasons, is the length of time prediction for Indian road projects, To address this issue, this study approach uses different methods to search for appropriate tools to estimate the length of road projects in which data collected are classified and analyzed. Data were collected from 2000 to 2018 on the 363 Government infrastructure projects (traditional contracting) Different methods such as Artificial Neural Network (ANN), Smoothing Methods, Time - Series, and Bromilow's time cost models are also being employed in this research. The findings of this study suggest smoothing techniques with a constant value of 0.3 resulted in a significantly less error of 1.2% since their results were much better compared to other methods. The market offers a range of methods for predicting construction time, based on costs such as the exponential smoothing technique, the time cost model Bromilow’s, the neural artificial network, and time series analysis.

DATA ANALYSIS

Used Tools For Prediction Of Construction Material

Machine learning tools as well as Knowledge-based systems (KBS)

1. Artificial Neural Network
2. Analysis of Regression
3. Analysis of Trends

The % of ANN data was fixed based on numbers of data as well as the best correlation between input and output variables for ANN training, testing, and validation. Some thumb rules include assigning 80% of the training and testing data to choose 20% for validation. As inverse proportion roughly equivalent to the square root of a total variable response quantity, percent testing data quantity is fixed. The total number of variable response data (cement price) in this study amounts to 183. The 183 square is 13.53 root. Consequently, 1/13.53, or 0.0739, about 7.4 percent of the validating data set. Therefore, the validity is reserved for 7.4% of the total response variable 183 x 7.4/100 = 14 (approximately). The balance dataset 183-14 = 169 is for training and validation to be split. Choosing the power of training and validation dataset influence how close apply heuristics Lowe et al. There is a better result with more training data set. K-Fold techniques for cross-validation are used to divide training and test data. The overall dataset to be divided into K is equalto N (Nx0.3)

Dataset strength

Approximately K = 54 = 3.33(169x0.3) K subset is 42.25 = 169/4

Training strength = 169-41 = 126

Data testing strength = 169-126 = 43 N

Data validation strength=183-169=14 N. Strength.

Precision was measured with MAPE (Mean absolute % error) MAPE = (Current value – Value predicted)/Current value

To compare precision, the MAPE valuation is tabled in Table 1.

Table 1 MAPE values of Cement price prediction

S.No	Trend Analys	Regression analysis	Artificial Neural Network
Average MAPE values Percentage	9.672	9.2	3.27

Construction Cost Index Prediction Tools

- Smoothing methods
- Artificial Neural Network
- Support Vector Machines

➢ **Prediction accuracy has been measured using**

- MAD Mean absolute deviation
- MSE Mean square error
- RMSE Root mean square error
- MAPE (Mean absolute percentage error)

The best prediction tools are identified using MAPE, MSE, RMSE, and MAD. The line of best fit of data points can be measured using MSE. The smaller value of RMSE indicates the more accuracy of the best fit of data points. MAPE and MAD are mostly the same. The difference of Actual and predicted value deviation can be calculated using MAD and percentage calculated using MAPE. The prediction error and accuracy can be measured widely using MAPE.

Error-values of different tools are tabulated in Table 4.3.

Table 2 Error values of different tools

S.No	Name of the tool	Error comparison		
		MAPE	MSE	RMSE
1	Smoothing Techniques	0.008	0.0052	0.072
2	Artificial Neural Network	0.78	1.87	0.37
3	Support vector machine	5.78	112.28	10.60

CONCLUSION

- Further attention is given to Construction Cost Prediction. In the last four decades, the research progress in this field has increased rapidly in developing countries.

- This critical study has found the relevance of building cost forecasts in the academic and industrial fields and provides researchers with a broad platform.

- The documents of this evaluation report provide industry people with detailed knowledge for the positive management of their projects. There are countless prediction tools on the market, including the best tools based on precision and difficulty.

- Accurately predicting material prices always is one of the primary tasks of construction companies and contractors. These results can be used in the planning and operation of upcoming projects. There will be a maximum fluctuation of 10 percent of prices. The neural network usually produces a better solution based more on historical data with influential factors during training and testing. Thus, the other techniques' disadvantages can be overcome. For the construction industry, the comparative results of this study would've been useful for future tendering.

- The construction cost index prediction is not a straightforward task, because fluctuations exist throughout the year between influenced factors. The current study has also some limitations, all types of prediction tools are assumed to be consistent for unavailable data between the affected factors.

- Finally, the collection of data in India is one of the main constraints. Some of the unavailable information is managed using the econometric method, for example, time range analyses since it can be obtained from minimum data. Predictions are made using a non-economic method, such as layering techniques, artificial neural networks, and vector supporting machines after careful examination of the data.

- The smoothing technique gives a better result compared with other predictive procedures, as mentioned throughout the output. The predicted volatility of CCI prevents underestimating and overestimating the volume surveyor.

- The study also suggests that certain other predictive tools available on the market may be used to predict the CCI of the CIDC in the future. It can be asked how various models perform during the prediction of index accuracy.

- The overrun of costs and time is directly connected with the Indian construction projects. It, therefore, needs a reasonable approach to deliver, reduce the overriding problem of time and costs. The Time Cost model of Bromilow's in Indian Projects is not efficient. This type of issue also affects generally developed countries.

- Currently, an improved model is structured with additional influenced factors as well as incorporated into the existing equations such as time-cost model propagation, logarithmic regression, and cubic reversion, exponential regression, and quadratic regressions. The value of R^2 is under 0.75, but in that work, the value of R^2 is 0.824. The basic criteria for the development ofthat kind of model. The fundamental model can assess the same thing. The Artificial Neural Network delivers the successful performance with constant 0.3 and 0.9 smoothing techniques, lower than 10 percent error margins in predicting accuracy, compared to all other prediction techniques.

REFERENCES

1. Ashuri,B. and Lu,J., Time Series Analysis of ENR Construction Cost Index, *Journal of Construction Engineering and Management*, 136 (11) (2010), 1227–1237.

2. Abu Hammad,A. A., Ali,S. M. A., Sweis,G. J., and Sweis,R. J., Statistical Analysis on the Cost and Duration of Public Building Projects, *Journal of Management in Engineering*, 26 (2) (2010), 105–112

3. Arbietman,D., Lirov,E., Lirov,R., and Lirov,Y., E-Commerce for Healthcare Supply Procurement., *Journal of healthcare information management : JHIM*, 15 (1) (2001), 61–72.

4. Cao,M.-T., Cheng,M.-Y., and Wu,Y.-W., Hybrid Computational Model for Forecasting Taiwan Construction Cost Index, *Journal of Construction Engineering and Management*, 141 (4) (2015), 04014089

5. Jour,A. and Nahmens,I., Volatility Forecast of Construction Cost Index Using General Autoregressive Conditional Heteroskedastic Method, *Journal of Construction Engineering and Management*, 142 (1) (2016), 04015051.

6. Knox,S. and Burkard,A. W., Qualitative Research Interviews, *Psychotherapy Research*, 19 (4–5) (2009), 566–575.

7. Mohamed,A. and Celik,T., Knowledge Based-System for Alternative Design, Cost Estimating and Scheduling, *Knowledge-Based Systems*, 15 (3) (2002), 177–188.

8. Regmi,H. R., Sharma,A., Pokharel,P., and Mahato,S. N., On TECHNICAL EXCHANGE ON ECONOMIC CENSUS WITH CAPMAS , EGYPT, (March) (2019), 1–29..

9. Smith,A. and Mason,A. K., Cost Estimation Predictive Modeling: Regression versus Neural Network, *Engineering Economist*, 42 (2) (1997),

10. Sjöström,C., Durability of Building Materials and Components 7, *Durability of Building Materials and Components 7*, 9781315025 (2014), 1–685

11. Tysoe,B. A., Construction Cost and Price Indices: Description and Use. Spon Press.

12. Wilmot,C. G. and Mei,B., Neural Network Modeling of Highway Construction Costs, *Journal of Construction Engineering and Management*, 131 (7) (2005), 765–771.

13. Xu,J. and Moon,S., Stochastic Forecast of Construction Cost Index Using a Cointegrated Vector Autoregression Model, *Journal of Management in Engineering*, 29 (1) (2013), 10–18.

Corresponding Author

Shivani Kankate*

JSPM'S Pune