(#1) Evaluating Construction Cost Impacts of Building Parameters Using Artificial Neural Networks

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Abstract

The accurate estimation of construction costs is a critical, yet complex task influenced by numerous variables. Traditional methods often fail to provide reliable early-stage cost estimates, leading to budget overruns and project delays. This research addresses this gap by focusing on identifying and ranking the most significant factors affecting the construction costs of residential buildings with less than four stories. Specifically, the study leverages Artificial Neural Networks (ANN) to enhance the accuracy of cost predictions by considering multiple building parameters. This approach is aimed at improving budgeting processes and resource allocation in the construction industry.

Keywords: *Artificial Neural Networks (ANN), Building Parameters, Cost Estimation, Construction Costs*

Introduction

The accurate estimation of construction costs is a critical, yet complex task influenced by numerous variables [1]. Traditional methods often fail to provide reliable early-stage cost estimates, leading to budget overruns and project delays [2]. This research addresses this gap by focusing on identifying and ranking the most significant factors affecting the construction costs of residential buildings with less than four stories. Specifically, the study leverages Artificial Neural Networks (ANN) to enhance the accuracy of cost predictions by considering multiple building parameters. This approach is aimed at improving budgeting processes and resource allocation in the construction industry. Consequently, the scope of the research is narrowed down to investigating the impact of building parameters on construction cost using Artificial Neural Networks, with a particular focus on low-rise residential buildings in Sri Lanka.

Methodology

Initially, a comprehensive literature review was conducted to identify 21 factors and 24 building parameters that significantly influence construction costs. To validate these findings, a quantitative approach was adopted, with survey and case study serving as the two main strategies for further proceedings. A structured questionnaire was distributed to 32 construction professionals, aiming to pinpoint the most critical factors and parameters specific to low-rise residential buildings. The survey responses were analyzed to select the input variables for the ANN models. Subsequently, twelve case studies of low-rise residential building projects from the Sri Lankan construction industry were selected to train the cost prediction models. These case studies provided real-world data, ensuring the models' accuracy and relevance. The parameters chosen for each building element served as independent variables in the ANN models, influencing the construction cost predictions.

Findings and Discussion

The ANN model demonstrated its effectiveness in predicting the construction costs of building elements, emphasizing the significance of specific inputs. The research identified ten factors as highly significant in influencing construction costs, including Gross Internal Floor Area (GIFA), the number of floors, height between floors, and external wall area. Additionally, nine other factors were categorized as significant, further refining the cost estimation process. The findings revealed that ANN-based models could provide more accurate cost predictions compared to traditional estimation methods. The model's ability to process multiple parameters and consider their combined effects resulted in enhanced prediction accuracy and reliability. This highlights the potential of ANN in revolutionizing cost estimation practices in the construction industry.

Conclusion

This study underscores the efficacy of Artificial Neural Networks in predicting construction costs based on various building parameters. By offering a more precise and reliable estimation method, the research contributes to the improvement of budgeting processes in construction projects. The ability to accurately predict costs at the early stages of a project can significantly impact its successful completion within budget constraints. The study also emphasizes the importance of considering specific building parameters in cost

estimation models. The identified significant factors and parameters can serve as a foundation for further research and development of advanced cost prediction models. Ultimately, the integration of ANN into construction cost estimation practices can lead to more efficient resource allocation and project management, benefiting the construction industry as a whole.

Directions for Further Research

Below are a few ways this research could be further developed.

- Expanding the research context by incorporating additional factors or parameters along with more detailed project information.
- Extending the study to cover various types of buildings as well as civil engineering projects.
- Currently, this study evaluates the cost implications for 12 main building elements. Further research could include additional elements, if applicable.

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