



# **APPLYING CONSTRUCTION COST DATA FOR PREDICTING COST OVERRUNS AND MITIGATING THEIR EFFECTS ON CONSTRUCTION PROJECTS DELIVERY**

**BY**

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# INTRODUCTION

- ❖ Prediction of construction cost is important to stakeholder
- ❖ Accurate cost estimation during project preparation is essential
- ❖ Traditional approach lack reliable data and information
- ❖ Data has transformed into valuable assets by automation
- ❖ Data mining help to convert historical data into decision-support systems
- ❖ Issues insufficient data/information for reliable cost estimation

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# Cost Overruns in Construction Projects

- ❖ Cost overrun is a serious issue in construction projects
- ❖ Cost overrun: difference in original contract value and completion cost

*Hinze et al. (1992)*

- ❖ Cost overrun: difference between forecasted and actual construction costs

*Flyvbjerg et al. (2002) and Odeck (2004)*

- ❖ 9 of 10 projects face cost overruns which commonly range between 50 to 100%

*Love et al. (2016).*

- ❖ In Nigeria, construction cost overruns recorded the same situation:

- ✓ Cost and time overrun is 38.25% in building projects.

*Abdulkabir et al. (2017)*

- ✓ Entire 30 building projects used (an average cost overrun of 44.46%.)

*Saidu & Shakantu (2017)*



# Causes of Cost Overruns

- ❖ Poor contract management
- ❖ Changes and errors in design
- ❖ Price fluctuation
- ❖ Construction claims
- ❖ Poor cost estimation

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# Applying Construction Cost Data for Predicting Cost Overruns

- Cost performance on a construction project remains one of the main measures of success
- Cost performance will affect the performance of other variables directly or indirectly.
- Estimating reliable costs that will not result in overruns can be challenging due to the complex web of cost-influencing factors
- Several studies have been done to predict the cost overruns of construction projects:
  - **Plebankiewicz (2018)** developed a model to predict cost overruns in construction
  - **Shoar et al. (2022)** proposed a robust random forest (RF) regression model to predict engineering services cost overruns (ESCOs) considering both project-related and organizational-related variables
- Data mining helps transform information embedded in the construction data into decision-support system  
*Ahiaga-Dagbui & Smith (2014)*
- Combination of non-parametric bootstrapping and ensemble modelling in artificial neural networks  
*Ahiaga-Dagbui & Smith (2014)*
- Data mining discover hidden patterns and relationships to find predictive information  
*Ahiaga-Dagbui & Smith (2014)*



# Data Mining Process

Framework for selecting a data mining technique

<b>Data mining category</b>	<b>Data mining requirement</b>	<b>Data mining techniques</b>	<b>Technique characteristics</b>
Regression	Prediction	Regression	Flexibility
Clustering	Pattern discovery	Support vector machine	Accuracy
Classification	Surveillance	Self-organizing maps	Power
Visualisation	Performance	Generic algorithm	Interpretability
Summarization	Measurement		Ease of development
	Business Understanding		



# Data Selection

- ❖ Initial dataset contained over 5000 projects (Big data) completed between 2000 and 2012.
- ❖ The project cost ranged from £1000 to £30million.
- ❖ One of the clusters containing about 1600 projects completed between 2000 and 2012 was used for the model
- ❖ Using stratified random sampling.



# Data Pre-Processing



- ❖ The next stage involved deciding which predictors to use in the modeling exercise.
- ❖ It was easy to remove predictors such as project manager, project ID, or year of completion from the set of predictors on precursory examination as they were likely not to be good predictors when the model is used in practice.



# Development of the Model

- ❖ The cost models were developed using an iterative process of fine-tuning the network parameters and inputs until acceptable error levels were achieved or when the model showed no further improvement.
  - ❖ The model training began with a search for optimal model parameters
  - ❖ Two different network architectures, the Multilayer Perceptron (MLP) and the Radial Basis Function (RBF), were experimented with at this stage
    - ✓ RBF models the relationship between inputs and targets in 2 phases: it first performs a probability distribution of the inputs before searching for relationships between the input and output space in the next stage
- (StatSoft Inc. 2008).*
- ✓ MLPs on the other hand model using just the second stage of the RBF. The MLP models were superior to the RBF networks and so the rest of the modelling was carried out using just MLPs.



# Validation of the Model

- ❖ The model was validated using bootstrapping and ensemble network
- ❖ It provides an avenue for using subsamples from a sample in a manner that addresses the variability and uncertainty in statistical inferences
- ❖ Traditional approaches to statistical inference are based on the assumption of normality in the data distribution.
- ❖ All modelling techniques are prone to two main types of error, bias, and variance

*Ahiaga-Dagbui & Smith (2014),*

- ✓ The result shows that 92% of the 100 validation predictions were within  $\pm 10\%$  of the actual final cost of the project while 77% were within  $\pm 5\%$  of the actual final cost.
- ❖ This implies that the cost overrun predicted by this model is  $\pm 5\%$  of the final cost obtained using the model.



# Effects of Cost Overruns on Construction Projects

- ❖ Cost overruns have variety of detrimental effects on the construction project's performance, quality, and reputation.
- ❖ These effects include:
  - ✓ lowered profit or return on resources invested,
  - ✓ stakeholders' dissatisfaction,
  - ✓ damaged reputation especially professionals involved,
  - ✓ disputes - project abandonments, arbitration or litigation



# Mitigating the Effects of Cost Overruns in Construction Projects

- ❖ Robust bid evaluation to ensure most economically bid adoption
- ❖ Project planning mitigation measures
- ❖ Contractor selection - based on contractor experience in similar projects
- ❖ Collaborative and cooperative efforts of the stakeholders essential to fight corruption

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## Conclusion

- ❖ Model should be used as a benchmark for predicting cost overruns in practice
- ❖ Model predicted the final cost with an error of  $\pm 5\%$ , if adopted this percentage should be added as a likely cost overrun to be encountered during execution
- ❖ Bid evaluation and project planning mitigation measures positively affect efficiency and contract management- and design-related causes.
- ❖ Project initiation and contractor selection mitigation measures positively affect:
  - ✓ Claim management,
  - ✓ Efficiency and contract management,
  - ✓ Estimation and scheduling, and
  - ✓ Design-related causes.

## Recommendations

- ❖ Nigerian Institute of Quantity Surveyors should invest more in the NIQS Cost Data Bank
- ❖ Nigerian Institute of Quantity Surveyors should commission and finance research

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**THANKS  
FOR  
LISTENING**

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