



School of Computing, Engineering, and the Built Environment Edinburgh Napier University

PHD STUDENT PROJECT

Funding and application details

Funding status: Self funded students only

Application instructions:

Detailed instructions are available at <https://blogs.napier.ac.uk/scebe-research/available-phd-student-projects/>

Prospective candidates are encouraged to contact the Director of Studies (see details below) to discuss the project and their suitability for it.

Project details

Supervisory Team:

- DIRECTOR OF STUDY: Nimi Dan-Jumbo (Email: N.Dan-Jumbo@napier.ac.uk)
- 2ND SUPERVISOR: Dubem Ikediashi

Subject Group: Built environment

Research Areas: Built Environment

Project Title: Improving Post Contract Cost-Control Estimates using Artificial learning (AI) and Machine Learning (ML)

Project description:

Construction projects infamously suffer from significant financial losses and possible ultimate project failure as a result of poor financial management due to poor budgeting, cost prediction, monitoring, and not well-informed commercial management decisions. To date, various cost management techniques and models have been utilised to ensure cost performance, however, building projects are rarely finished within the budgeted cost and time frame.

For contracting organisations, successful construction projects are mainly the ones that meet or exceed the expected return on investment (ROI). Effective financial

management occurs when line items whose actual costs exceed the budgeted costs are identified, total cost at completion is estimated and profit margin is maintained or maximised. Current studies show profit margins are typically slender i.e., between 2%-7% from large annual turnovers. Globally, despite the improvements in construction financial management, cost overruns remain a major issue with project performance.

Studies speculate that successful controls happen through the application of mature and practical commercial management techniques. However, the government has placed a strong emphasis on the need for the construction industry to transition from a change agenda that was management-focused to one that is more technocentric and sees measures to improve the sector through the use of digital technology and other Industry 4.0-enabling technologies.

Currently, artificial intelligence (AI) is transforming sectors like manufacturing, retail, and telecommunications, with the construction industry being one of the least digitised industries. AI has the capability to significantly improve construction industry efficiency and service processes, along with enhancing automation. Also, it is able to give businesses a more competitive edge over traditional methods. Using artificial intelligence (AI) and machine learning (ML), the doctoral research will propose workable digital solutions that can address obstacles and promote opportunities to enhance cost control performance for building projects.

This doctoral research aims to develop a novel approach that utilises AI and ML capabilities to: generate more reliable and accurate budgets, accurately monitor performance, accurately identify possible causes of variance; and suggest effective corrective actions for ongoing and future projects occur. AI and ML methods will be employed in mining historical data in a variety of formats and quality levels to facilitate analysis and expand the methods' ability to generate more precise estimates.

The approach also has the potential to deliver improved post-contract financial management by performing cost value reconciliations (CVR), cashflow calculations, budgeting, identifying possible causes of variance, as well as suggesting corrective actions. Ultimately, the project will help curb risk to organisations profit margin, keep project costs within budgets, and forecast the consequences of decisions and out-turn costs.

This project will lie at with the interface between the Built environment and data science/AI. Motivated applicants from both disciplines are welcome but must be able to work well as a part of a multi-disciplinary team. The scope of the project can be tailored as required, and the successful applicant will be supported by a multi-disciplinary team of supervisors.

References:

- [1] Ross, A. and Williams, P., 2013. Financial management in construction contracting. John Wiley & Sons.
- [2] Igwe, U.S., Mohamed, S.F., Azwarie, M.B.M.D. and Paulson Eberchukwu, N., 2020. Recent developments in construction post contract cost control systems. *Journal of Computational and Theoretical Nanoscience*, 17(2-3), pp.1236-1241.
- [3] Stephenson, P. and Hill, M.S., 2005. Cost Value Reconciliation (CVR) in the UK construction industry. Australia: Queensland University of Technology.
- [4] Pan, Y. and Zhang, L., 2021. Roles of artificial intelligence in construction engineering and management: A critical review and future trends. *Automation in Construction*, 122, p.103517.

Candidate characteristics

Education:

A first-class honours degree, or a distinction at master level, or equivalent achievements in Built Environment or Computer Science

Subject knowledge:

- Construction commercial management
- Quantity surveying
- Construction management
- Computer Sciences

Essential attributes:

- Familiarity with commercial management, quantity surveying /or artificial intelligence, and machine learning
- Ability to work as part of an interdisciplinary team
- Ability to carry out and communicate scientific research

Desirable attributes:

- Knowledge of Management Accounting