



## **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: Dr. Timothy OLAWUMI (Email: T.Olawumi@napier.ac.uk)
- 2<sup>ND</sup> SUPERVISOR: Dr. Nirodha Fernando

**Subject Group:** Built environment

**Research Areas:** Architecture, Building & Planning

**Project Title:** BIM-based expert system for predicting CO2 emissions at the project design phase decision-making

**Project description:**

In recent years, human activities and rapid urban developments have negatively affected the ecosystem and quality of life. The planet's temperature has risen by 2 degrees following the Industrial Revolution, and it is predicted that this number will be added to the overall impact by 2050. Such changes continually look unsustainable in the long run and pose a real threat to the existence of human life and the liveability of cities.

It is estimated that the construction industry accounts for about 40% of greenhouse gas emissions. The high CO2 emissions destroy the environment and the ozone

layer that protects the earth from high-energy UV rays from the sun. Accordingly, the United Nations Framework Convention on Climate Change (UNFCCC) demanded different nations reduce CO<sub>2</sub> emissions by 50 per cent by 2050 as a long-term plan. Close cooperation among governments, private companies, and individuals worldwide is required to achieve this goal. In line with the long-term plan proposed by UNFCCC, this PhD project aims to take some important and effective steps to protect the environment by adopting an innovative technological approach towards significantly reducing CO<sub>2</sub> emissions in buildings.

In this new approach, decision makers (project managers, developers, government departments, and homeowners) would evaluate their options for improving environmental performance through using low-carbon materials, a pro-environmental project delivery system, or appropriate project management tools and techniques. This PhD project introduces a new dimension based on the BIM plugin, which uses data on factors and behaviours that reduce CO<sub>2</sub> emission in buildings (i.e., such data will be collated, modeled, and analysed). Hence, any decision (such as on materials, design, building systems, and the like), when imported into the BIM software or a relational database, the developed BIM plugin picks up the parameters and various information of each decision and estimates the CO<sub>2</sub> emissions which are then used for decision-making.

Prospective applicants are encouraged to contact the Supervisor before submitting their applications. Applications should make it clear what project you are applying for and the names of the supervisors.

#### References:

- [1] Olawumi, T.O., Chan, D.W.M, Saka, A.B., Ekundayo, D., & Odeh, A. O. (2023). Are there any gains in green-tech adoption? Unearthing the beneficial outcomes of smart-sustainable practices in Nigeria and Hong Kong built environment. *Journal of Cleaner Production*, 410 (15 July), 15pages, Article Number 137280. <https://doi.org/10.1016/j.jclepro.2023.137280>
- [2] Olawumi, T.O., & Chan, D.W.M (2022). Cloud-based Sustainability Assessment (CSA) System for Automating the Sustainability Decision-Making Process of Built Assets. *Expert Systems with Applications*. 188 (February) Article ID 116020. <https://doi.org/10.1016/j.eswa.2021.116020>
- [3] Olawumi, T.O., & Chan, D.W.M. (2020). Application of Generalized Choquet Fuzzy Integral Method in the Sustainability Rating of Green Buildings based on the BSAM scheme. *Sustainable Cities and Society*, 61, Article 102147. <https://doi.org/10.1016/j.scs.2020.102147>
- [4] Olawumi, T.O., & Chan, D.W.M., Chan, A.P.C., & Wong, J.K.W. (2020). Development of a Building Sustainability Assessment Method (BSAM) for Developing Countries in Sub-Saharan Africa. *Journal of Cleaner Production*, 263, 121514, 17 Pages. <https://doi.org/10.1016/j.jclepro.2020.121514>
- [5] Olawumi, T.O., & Chan, D.W.M (2020). Green-Building Information Modelling (Green-BIM) Assessment Framework for Evaluating Sustainability Performance of Building Projects: A Case of Nigeria. *Architectural Engineering and Design Management*. pp 1-20. <https://doi.org/10.1080/17452007.2020.1852910>

## **Candidate characteristics**

### **Education:**

A first-class honours degree, or a distinction at master level, or equivalent achievements in Construction Management, Environmental Engineering, Civil Engineering, Architecture, Building, Surveying, or a related discipline with a good fundamental knowledge of BIM, green buildings, and sustainability assessment in buildings

### **Subject knowledge:**

- Experience in fundamental BIM and sustainability related to buildings/green buildings

### **Essential attributes:**

- Experience in fundamental BIM and sustainability related to buildings/green buildings
- Competent in data modelling and analysis.
- Knowledge of BIM, building environmental performance operational and embodied carbon
- emissions and their relation to building design and systems.
- Good written and oral communication skills
- Strong motivation with evidence of independent research skills relevant to the project
- Good time management

### **Desirable attributes:**

- Positive, passionate, team player, hardworking and self-motivated
- Ability to do research independently with minimal supervision
- Knowledge of System Dynamics modelling, 81M plugin development or similar ones.