Department	School of Engineering and the Built Environment
Supervisors	Dr Timothy Olawumi; Dr Fernando Nirodha; Dr Temidayo Osunsanmi
Project Title	BIM-based expert system for predicting CO_2 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 CO_2 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_2 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_2 emissions in buildings.

In this new approach, decision makers (project managers, developers, government departments, 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 BIM - BIM plugin, which uses data on factors and behaviours that reduce CO_2 emission in buildings (i.e., such data will be collated, modelled, and analysed). Hence, any decision (such as on materials, design, building system, 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_2 emissions which is then used for decision making.

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

Academic qualifications
A first degree (at least a 2.1) ideally in Construction Management, Environmental Engineering, Civil Engineering, Architecture, Building, Surveying, or a related discipline with a good fundamental knowledge of BIM, green buildings, sustainability assessment in buildings, .

English language requirement
IELTS score must be at least 6.5 (with not less than 6.0 in each of the four components). Other, equivalent qualifications will be accepted. Full details of the University's policy are available online.

Essential attributes:

- Experience of 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 its 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, BIM plugin development or similar ones.

Indicative Bibliography	1. 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 2. 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 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
Enquiries	For informal enquiries about this PhD project, please contact Dr. Timothy Olawumi – T.Olawumi@napier.ac.uk
Web page	https://www.napier.ac.uk/research-and-innovation/research-degrees/application-process