# Graph Database or RDF (Resource Description Framework) Database as an heterogenous data mapping tool for linking construction data

## Introduction

The construction industry is faced with numerous challenges including low productivity, lack of research and development, and poor technology advancements. Advances in digital technologies such as digital twin (DT) has seen enormous utilizations in digitally advanced industries including the manufacturing and automotive industries. It presents an opportunity for the integration of the physical world to the digital world. DT technology has the potential to transform the construction industry and provide responses to some of its challenges. As a result, the concept of DT has attracted much attention and is developing at a rapid pace (Opoku *et al.*, 2021).

The industry is perceived and listed as being part of the least digitalized industries and also slow to innovation especially in its adoption of digital technologies. The adoption of technologies like Building Information Modeling (BIM) presented some evidence of change within the construction industry. The global BIM adoption has been slow due to the perceived risks and challenges associated with its development. Furthermore, due to lack of knowledge and understanding of the technology, individuals and organizations have misconceptions about the potentials of BIM in tackling challenges of the industry and this has resulted in its partial or total abandonment in construction projects (Opoku *et al.*, 2021)

## Problem statement

Within the life cycle of a building project (i.e from conception up until operational maintenance), buildings are now producing more data than ever before, from clash detection, issue tracking, scheduling, bill of quantity, model checking, energy usage, utility information, occupancy patterns, weather data, etc. In order to manage a building holistically, it is important to use knowledge from across these information sources. However, many barriers exist to their interoperability and there is little interaction between these islands of information. Currently, these information are located in different storage silos, depending on the use case (software solutions), and are not in most cases connected to the BIM model. This serves as a deterrence in the implementation of BIM for most construction companies as they have to subscribe to multiple BIM software solutions.

There is a critical need to reflect on the design of storage-based data services and how they are designed from an interoperability perspective. If new data-based management systems are designed in the same

manner as traditional building management systems, they will continue to suffer from the data interoperability problems.

Linked data technology leverages the existing open protocols and W3C standards of the Web architecture for sharing structured data on the web. Linked data as an enabling technology for storing building data services. The objective of linking building data in the cloud or wherever it is stored is to create an integrated well-connected graph of relevant information for managing a building (Curry *et al.*, 2013).

**Aim and objectives**

The proposed aim of the master thesis is to propose a suitable database management system for linking the data generated during the construction phase and the objectives would be to compare the performance of two main database management approach namely;

1. Graph database approach using neo 4js
2. RDB database approach

**Research methodology**

The proposed research methodology which would change as the research progresses, would be implemented in the steps as listed below

1) A literature review on the different data types generated during the construction phase, current method of storing each data type in their different storage silos and their problems, and finally the review of the two main graph database approach to link all data types.
2) Collect different data sets of different data types from a test building.
3) With the data collected, we compare the performance of the two main database management under different characteristics such as scalability, flexibility, query efficiency, functionality.
4) A conclusion on which database management is best suitable for mapping construction datasets.
5) Deploy the proposed database management as a front-end client-based solution for visualization.

**References**


1. Curry, E. *et al.* (2013) 'Linking building data in the cloud: Integrating cross-domain building data using linked data', *Advanced Engineering Informatics*. Elsevier, 27(2), pp. 206–219. doi: 10.1016/J.AEI.2012.10.003.
2. Opoku, D. G. J. *et al.* (2021) 'Digital twin application in the construction industry: A literature review', *Journal of Building Engineering*. Elsevier, p. 102726. doi: 10.1016/j.jobe.2021.102726.