Project Title Developing Smart Modern Construction Enterprise Typologies for the 21st Century Construction Futures

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1.0   Background

Construction enterprises are challenged to become smart and modern in this 21st century as the world moves in to the 4th industrial revolution. In past years, the construction industry has been criticized for being fragmented and inefficient; with almost two thirds of construction businesses not being innovative (KPMG, 2016). However, the advent of smart and digital technologies in the 21st century has made it necessary for construction enterprises to adopt new technologies and changes (Ergen et al. 2007). Notwithstanding, the pressure to bridge the enormous gap that exists between efficiencies of construction and other industries such as manufacturing is at its peak. Essentially, despite the urgent need for construction businesses to embrace digitalisation in the rapidly evolving modern world, many of today's construction enterprises are locked into the momentum of their past practices and ideologies. Whilst some enterprises are gradually making changes and embracing digitalisation and industrialisation, others are completely stuck in the traditional methods of construction delivery or piecemeal changes to delivering construction projects (Clegg et al. 2017). Against this backdrop, it has become imperative for more research to be conducted to explore how different construction enterprises can successfully adapt and fit within the rapidly evolving digitalisation and modernised world (Li, 2018).

Smart technologies and digitalisation are believed to have emerged from Sci-Fi movies; and over the last couple of decades, ideologies from these Sci-Fi movies have become reality and are changing the way industries including construction operate (Zinkel, 2017). Some smart technologies that have emerged in the construction industry include Virtual Reality (VR), Augmented Reality (AR), drones, backup cameras, radio frequency identification tags, Building Information Modelling and optical character recognition (Ergen et al, 2007; Lacovidou et al. 2017). Considering the hastily emergence of smart technologies, researchers have also attempted to explore the mechanisms and best practices for the adoption of these technologies in construction process (Ergen et al, 2007). Apparently, the outputs from past studies on smart technologies are informing companies' policies as well as transforming construction processes to enhance efficiency, safety and sustainability. Following, the advent of smart technologies, the concept of modern methods of construction has also evolved. Like smart technologies, many different modern construction techniques have emerged in recent years in the construction industry and examples include prefabrication, modularization and Design for Manufacture and Assembly (DfMA) (Pan et al. 2007; Li and Ma, 2017; Said, 2015). Similarly, several researchers have developed models that could aid construction firms to effectively utilize the emerging modern methods of construction (Pan et al. 2008).

Despite the extensive discussions and investigations by researchers in smart technologies utilisations and modern construction, there has not been any attempt to link these different but related concepts together (Pan et al. 2008; Ergen et al, 2007). In fact, smart technologies and modern construction has always been studied in isolation. However, in this 4th industrial revolution era, it has become necessary for the two rapidly evolving areas to be consolidated into one concept; i.e. Smart Modern Construction and investigated holistically. This will enable construction business to have a better experience of the rapidly changing world. Smart Modern Construction (SMC) simply denotes a bridge between smart technologies and modern construction. This new concept integrates digitalisation, globalisation, resilience, industrialisation and modernisation so that construction enterprises can fully and efficiently explore the

opportunities and enhance their performance in the digitalised and globalised world.

2.0   Research Problem

Over the last couple of decades, considerable amount of literature has evolved on smart technologies and modern construction (Li & Ma (2017; (Arantes, Ferreira, & Costa, 2015). The germane literature has comprehensively discussed the possible ways of imbedding digital smartness such as Automation, Building Information Modelling, Design for Manufacture and Assembly (DfMA), IoT (Internet of Things), VR and Augmented Reality, Robotics in construction (Li & Ma, 2017). The outputs of past studies are gradually transforming construction processes. Further, past research outputs have provided effective procedures and models that have accelerated construction businesses' desire to adopt off-site, prefabricated and pre-assembled construction techniques. However, despite the large strand of research, no research has been conducted in Smart Modern Construction particularly on how different construction businesses should approach and define their value propositions in this newly evolving construction market. In fact, many construction enterprises have little knowledge on the best practices, available opportunities and benefits of embracing Smart Modern Construction (Sarker, Egbelu, Liao, & Yu, 2012).

This project therefore explores the types of construction enterprises that are emerging due to the pressures of digitalisation, globalisation, industrialisation, sustainability and resilience. It will further evaluate how construction enterprises can redefine their market opportunities and customer base, the value proposition in Smart Modern Construction and how these will be fulfilled and assured. Moreover, the project will investigate how enterprises approach business planning, attract investment and create enterprise value in Smart Modern Construction through a purposive case study analysis. Also, the project will analyse how smart technologies and construction methods are being integrated to re-shape traditional supply chains and ensuing commercial procurement terms.

Finally, the project will develop a SMC enterprise typology that is defined by critical success factors (CSF) and key performance indicators (KPI) that are required to achieve competitive advantage. It is expected that the typology will define those enterprises that are measurably more competitive than their traditional peers.

3.0   Expected Outcomes

It is expected that this project will clearly articulate the various types of Smart Modern Construction enterprises. Further, the project will define the value propositions of construction enterprises in Smart Modern Construction. Also, this project will develop models that could aid Smart Modern Construction enterprises to attract investments, properly establish a business plan and create a formidable customer base. A project success index model will be developed for the various types of Smart Modern Construction enterprises. Finally, the best practices required for Smart Modern Construction enterprises to gain competitive advantage will be developed.

From these expected outcomes, the project will provide several implications for practice. First, different construction enterprises will be able to define their value propositions, goals and objectives in Smart Modern Construction. Second construction enterprises could establish a solid customer base informed through efficiency in terms of quality, time and cost. Third, Smart Modern Construction enterprises will considerably gain competitive advantage than their traditional peers in the digitalised and globalised construction market. Lastly, Smart modern Construction enterprises will be equipped with the latest knowledge on digitalisation and smartness.

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