Sustainable Maintenance Strategies for Government Office buildings in Emerging Economies

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Chapter 1

General Introduction

Abstract

In 2015, members of the United Nations adopted the 2030 agenda on 17 Sustainable Development Goals (SDGs), and developing quality, reliable, sustainable and resilient infrastructure, including public infrastructure, was one of the goals to be achieved by 2030. A recent (May 2024) evaluation of the progress on the SDGs revealed limited success in achieving the objectives of the 2030 agenda. The assessed targets for SDG 9 reveal that only 30% of them are on track or have been achieved, which falls short of the 2030 target values. The purpose of this chapter is to introduce the objective of this book, which is underpinned by the lack of progress in achieving targets of the 2030 agenda on SDG (9). More specifically, the chapter discusses challenges faced by emerging economies but not limited to poor maintenance of existing infrastructure, limited participation of trained construction professionals, limited maintenance budget and lack of government capacity to maintain government office buildings. The chapter brings forth key studies that have attempted to address the highlighted maintenance issues, along with the methodology adopted – the Delphi method – to determine and validate sustainable maintenance strategies for government office buildings in emerging economies.

Keywords: Sustainable development goal nine (SDG 9); resilient and sustainable infrastructure; emerging economies; building maintenance; political uncertainty; poor governance

Background

This chapter focuses on the importance of infrastructure maintenance in emerging economies. The significance of emerging economies cannot be overly emphasised, especially the impact they have on the global economic scene. Gourinchas (2024)

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elaborated on this significance alluding to the fact that growth in India and China will account for almost half of the global growth and account for almost 50% of the global economy's total consumption. World Economics (2024) note that, of the total GDP of the global economy; more than 40% is accounted to emerging economies. This book focused on emerging economies because of the impact these countries are forecast to have in shaping the global economy.

Emerging economies include countries such as Brazil, Russia, India, China and South Africa. The representation of these economies was coined BRIC, with the inclusion of South Africa in 2010 (France24, 2024). Jim O'Neill – a British economist, is credited to have proposed the BRIC abbreviation (France24, 2024). The role of these BRIC economies after the 2008 global financial crisis was eminent to reform and challenge Western dominance; however, they have not lived up to the expectations due to internal and external constraints of each economy (Darnal et al., 2023). In 2013 Stanley, a financial analyst classified Turkey, Brazil, India, South Africa and Indonesia as the 'Fragile five' a group of countries dependent on unreliable foreign investment for growth; however, fortunes have changed for India and Indonesia as their increasingly becoming investor favourites (Wong & Mazumdar, 2024). Amongst many challenges facing emerging economies is unpredictability when it comes to growth and development projections; however, they continue to play a significant role in the global scene.

In contrast to advanced economies, emerging economies are further likely to encounter challenges of stagnation in terms of their contribution to the global economy. The predicted growth of emerging economies is always difficult to determine due to multiple factors including encouraging fast and uncontrollable rates on economic growth, political instability, policy uncertainty, dilapidated infrastructure, poor governance and leadership vacuum in those economies (Acharya et al., 2023; Ruch, 2020). Ruch (2020) and Acharya et al. (2023) reveal that multiple economies have and still encounter multiple challenges when it comes to progressively evolving and graduating to the level of advanced economies. With all the challenges of emerging economies, it is critical to note that the economies continue to possess the capacity to advance the needs of their citizenry, notwithstanding the development of infrastructure.

For developing countries, the concepts of preservation of public assets and poor maintenance are nothing new. For example, in Nigeria, 80% of the buildings at the University of Nigeria require maintenance (Ayokunle et al., 2024; Odeyemi et al., 2019; Ugwu et al., 2018). Politicians, activists and the populace at large have raised concerns about the condition of infrastructure in Ghana. However, no meaningful or practical steps have been taken to address the challenges (Nkrumah et al., 2017). The study of Cobbinah (2010) on building maintenance assessed the existing conditions of buildings in Ghana and the need for maintenance. The study discussed maintenance policies and practices, the capacity of the institutions to undertake maintenance, causes of poor maintenance and the prioritisation of constructing new facilities over the maintenance of the existing ones (Mensah et al., 2023).

The challenges of poor maintenance in developing economies began with massive investment by national governments towards new infrastructure and a total

neglect of the sustainability of the existing infrastructure (Odeyemi et al., 2019). Existing buildings in Nigeria experience rapid deterioration whilst huge investments are made towards the construction of new assets (Olusola et al., 2016). In Ghana, the Ministries area of the Kumasi metropolis has faced challenges of neglect in the maintenance of the building structures of the metropolis (i.e. Ghana's health service, police service and University of Education Winneba, Kumasi campus), while there has been an increase in investment in the construction of new facilities across the country, especially in the capital city of Accra (Cobbinah, 2010). The need to prioritise the construction of new buildings over the maintenance of existing buildings must be reviewed by the national government in developing economies.

Siyanbola et al. (2013) and Olanrewaju et al. (2015) further point out that the limited participation of construction professionals and building users at the maintenance operations phase of the buildings' life cycle also affects the quality of maintenance in Nigeria. Lack of improved preventive maintenance schedules, unavailability of skilled workers and an over-centralised approach in the institutions additionally affect the undertaking of maintenance work (Barg et al., 2014; Kok et al., 2014; Oluwatayo et al., 2017). Organisations need to adopt a decentralised approach over a centralised approach. A decentralised approach indicates that the responsibility of maintaining public assets does not only lie with top management but also with employees and occupants of the building. The inputs of all stakeholders (top management, employees and occupants) are incorporated into strategic planning (Marchington & Parker, 1990; Oluwatayo et al., 2017). Kportufe (2015) and Ugwu et al. (2018), on the other hand, assert that for many years dating back to the years of independence Ghana and Nigeria's public buildings have not been in good condition. Amongst the factors affecting maintenance in the region include inaccurate and faulty building designs, use of inferior materials, poor workmanship, incorrect building usage, building used beyond design life of the structure without adequate maintenance, high maintenance costs and limited budgets, non-existent or poor implementation of maintenance policies, poor maintenance culture, inexperienced maintenance team and corruption. According to Kportufe (2015), if the designs at the initial stage of the project do not consider building fabrics that are weather protective, durable, noise absorptive, resistant to heat loss, visually appealing, safe and comfortable, the built infrastructure is bound to have maintenance issues as the obsolescence gap expands.

As much as maintenance is focused on retaining, restoring and improving not only the aesthetics of the building but also the ability of the building to perform its mandated functions, there are also barriers affecting the possibility of this outcome (Macek & Dobias, 2014). To ensure that organisations undertake building maintenance routinely, several barriers must be eliminated. Aghimien et al. (2019) submit that these barriers are best categorised under building design and usage factors, policy and management factors and human resources as well as funding factors. These barriers must be eliminated to improve the performance of the buildings. The major aspect of improving the performance of buildings is through the effective and appropriate selection of maintenance practices and activities (Velmurugan & Dhingra, 2015).

Unless the current barriers are eliminated, buildings are expected to continue to deteriorate and fail to meet their predetermined standards, thus affecting the performance of the organisation in meeting its targets. Issahaku (2013) postulates that without an adequate maintenance budget, disciplined building occupants who are educated about maintenance, a changed attitude of occupants towards maintenance and skilled personnel, organisations might not be able to meet their targets through improved building maintenance. It is not only the responsibility of the building owner to protect and ensure that the condition of the building is maintained but also that of the occupants. Ayoukunle et al. (2019) further emphasised the importance of policy improvement measures, including humans, material resources, computerised approach management, assessment and feedback mechanism measures, as key measures to minimise the impact of poor maintenance in university buildings in Nigeria.

This book focuses on government office buildings in emerging economies. In this book's context, the buildings are operated and managed by the government under the custodianship of state-owned entities. In countries such as South Africa, the Department of Public Works and Infrastructure, in collaboration with the Construction Industry Development Board, is responsible for planning and overseeing infrastructure delivery, including infrastructure maintenance (Department of Public Works and Infrastructure and Construction Industry Development Board, 2017). The two institutions are responsible for the development of the National Infrastructure Maintenance Strategies that focus on Category B institutions – that is, institutions that lack the capacity and resources to maintain their assets. In contrast, Category A institutions refer to capacitated departments with clear asset management plans and adequate maintenance budgets to undertake any infrastructure maintenance and refurbishment. Key components in Category B include reinforcing the existing regulatory framework, allocating adequate budgets for strategic infrastructure, providing institutions with non-financial resources and developing a continuous improvement process that encompasses monitoring, evaluation and feedback mechanisms (Department of Public Works and Infrastructure and Construction Industry Development Board, 2017).

Lack of support and direction from governments to maintain government buildings has led to the deterioration and failure of multiple buildings (Hatem & Zahraa, 2021). Over the years, maintenance of public infrastructure has been neglected and buildings have been left to deteriorate to the extent of affecting service delivery (Hatem & Zahraa, 2021). Exacerbating factors include but not limited to poor planning, poor management of resources, lack of coordination between institutions and stakeholders, lack of maintenance culture, limited budget and lack of understanding regarding processes and benefits of sustainable maintenance (Ngwenya, 2022). Building maintenance is a multidimensional concept that seeks to define the practices and activities undertaken to retain, restore and improve the condition and functionality of buildings throughout their life cycle using acceptable standards while managing and optimising maintenance resources and budget for the purpose of producing buildings that continue to serve their intended purpose (Puķīte & Geipele, 2017).

It is paramount firstly to understand building maintenance without the concept of sustainability and how it has evolved over time. Wood (2005, p. 292) shares that the widely adopted definition of maintenance is by the British Standard Institution (BS 3811) (1964), which defines maintenance as 'work undertaken in order to keep or restore every facility, i.e. every part of a site, building and contents to an acceptable standard'. Bushell (1984), on the other hand, defined maintenance as a combination of actions required at the planning and implementation stage of maintenance to retain and restore buildings to their acceptable condition. The definition was solidified in 1991 by BS 4778 (1991), and it referred to maintenance as a 'combination of all technical and administrative actions, including supervision actions, intended to keep an item in, or restore it to, a state in which it can perform a required function'. Retaining and restoring building functionality to acceptable standards seemed to be the key terms in the definition of building maintenance, with Allen (1993, p. 8) also stating that maintenance 'is the combination of all technical and associated administrative actions required to retain and item or restore it to a state in which it can perform its required function'.

The definition of maintenance which only focused on the restoration of building functionality was later refuted as being too constricted and lacked the holistic purpose of maintenance, indicating that in addition to maintenance being a retaining and restoring exercise, it must also improve the condition and functionality of the building and building components (Khalid et al., 2019; Puķīte & Geipele, 2017; Seeley, 1976). The Building Maintenance Committee (Department of the Environment, 1972) also emphasised the concept of improvement in the maintenance definition, which indicated that the purpose of building maintenance is to 'improve any facility, i.e. every part of a building, its service and surrounds to a currently acceptable standard and to sustain the utility and value of the facility' (Allen, 1993, p. 7). The improved definition of maintenance further highlighted the significance of a more sustainable maintenance approach, inclusive of retrofitting existing buildings to improve sustainability and energy performance. Paradis (2016) concurs that retrofitting existing buildings reduces energy consumption and the cost of cooling, heating and lighting of buildings over the construction of new buildings.

As a response to the complexities of buildings over the years, including the advancement of technology, globalisation and change of economy, the management concept was introduced in the building maintenance definition (Allen, 1993; Horner et al., 1997). The management aspect was introduced when the importance of policy, maintenance objectives, resource management and optimisation as well as the education and training of maintenance personnel started being a factor in the maintenance of built infrastructure (Allen, 1993). Daft (2004) and Koontz and Weihrich (2005) explain management as a procedure undertaken for the achievement of organisational goals using effective and efficient processes of planning, managing and optimising resources. Allen (1993, p. 8) thus defines maintenance management as the 'effective and efficient utilisation of resources to ensure that the building and its facilities are kept operable to standards required by the users' (McIntosh, 2011). On the other hand, Zawawi et al. (2011, p. 111) explain maintenance management as a process that 'involves planning, directing,

controlling, and organising maintenance activities and services to obtain maximum returns on the investment'. This current study accepts sustainable maintenance management as a procedure guided by a building maintenance policy, which allows the organisation and management of resources during the execution of maintenance to retain, restore and improve the condition and functionality of government office buildings to a condition that buildings optimally perform their required functions.

Sustainable maintenance for government buildings is further understood from the point of view of attributes adopted in the planning and implementation stages of maintenance operations. In this current study, sustainable maintenance for government office buildings was considered as a dependent (endogenous) variable in the study's conceptualisation while the constructs that measure sustainable maintenance were defined as independent (exogenous) variables. Maintenance strategy outcome features of sustainable maintenance also formed part of the study's conceptualisation. Pintelon and Gelders (1992) and Márquez and Gupta (2006) maintain that a comprehensively developed maintenance management framework must consist of three levels, namely strategic, tactical and operational. The following studies have explored and advanced the assessment of maintenance strategies that measure maintenance, namely those of Pintelon and Gelders (1992), Hassanain et al. (2001), Waeyenbergh and Pintelon (2002), Hassanain et al. (2003), Márquez et al. (2009) and López-Campos and Márquez (2010) at different levels. The strategic level of maintenance establishes alignment between organisational objectives and maintenance, while the tactical and operations level emphasises the allocation and management of resources as well as maintenance execution and control, respectively (Alzaben, 2015; Márquez & Gupta, 2006).

Dekker (1996), Geraerds (1995) and Arditi and Nawakorawit (1999) posit that the management of buildings cannot be holistically understood without deliberations on the involvement of building managers at the design stage of the built infrastructure, policies of the organisation, building condition assessments, use and impact of different maintenance practices and activities, procurement, frequency of the meetings with the building occupants, the severity of the complaints and prioritisation of maintenance tasks as well as the involvement of building designers at the occupancy stage. The focus of Arditi and Nawakorawit (1999) was on the role and involvement of building managers at the design stage and the involvement of the designers at the operations stage (Lee & Scott, 2008) of the building, which both act according to and are influenced by the requirements of the building occupants. This current study's identified gap in knowledge deliberated in detail on the outcome of facility management at the design stage, and the impact this has on maintenance models.

Garg and Deshmukh (2006) and Khalid et al. (2019) indicate that maintenance can be further assessed using maintenance optimisation models, maintenance techniques, maintenance scheduling, maintenance performance measurement and maintenance information systems, while Márquez et al. (2009) and Uday et al. (2009) focused on the strategic and the implementation stage of the maintenance strategy. Jones and Sharp (2007), Lee and Scott (2008) and Uday et al. (2009) maintain that maintenance policy, maintenance objectives and maintenance

strategy play a fundamental role in the initial stages of maintenance execution and control. It is thus evident that one of the critical strategies of building maintenance is policy (López-Campos & Márquez, 2010). Speight (1970) asserts that policy includes the development of a building register that defines the condition of the building components and the acceptable standards of each component which are essential for its upkeep. The BS 8210 (1964) points out that a well-defined maintenance policy should ensure that value for money for the building is achieved, and that the same value and resource value of the infrastructure are protected as well as the owner of the building against any foreseeable breaches of statutory and legal obligations.

In addition to the strategies of maintenance, Meidan (1986) points out that evaluation and control of maintenance implementation are also critical. These measures explain the efficiency of maintenance operations (Khalid et al., 2019). Continual performance improvement measures, including performance reporting, focus on the efficiency and effectiveness of the building maintenance management operations (Márquez et al., 2009; Myeda et al., 2009; Vanneste & Van Wassenhove, 1995), which evaluate the usefulness of the processes and the optimisation of resources (Lateef et al., 2009; Zawawi et al., 2011).

Regardless of the importance of maintenance on the restoration and improvement of the condition of public buildings, functionality attributes that measure the construct (maintenance) are still assessed in the body of knowledge in a manner that is not holistically organised or understandable, especially in developing countries. Maintenance is also found in different multiple disciplines (aviation, manufacturing, information technology, civil engineering, construction building technology, automation control systems), thus indicating the constructs that measure the concept have become more difficult to comprehend (Genov, 1991). The methodology employed, differences in samples used as well as the way in which the variables are defined in previous studies also affect the identification of attributes that measure the maintenance of public buildings (Hassanain et al., 2001, 2003; López-Campos & Márquez, 2010; Márquez et al., 2009; Pintelon & Gelders, 1992; Waeyenbergh & Pintelon, 2002).

In addition to maintenance being multidimensional, challenges affecting the understanding of the concept are also due to the lack of empirical evidence as to how maintenance should be achieved. It is based on this evidence that this current study seeks to organise the strategies that predict sustainable maintenance for government office buildings in emerging economies. Emerging economies were chosen for this study because of the limited body of knowledge on the conceptulisation of sustainable maintenance strategies for government office buildings. Many government office buildings in emerging economies are confronted with poor maintenance, which has exacerbated the deterioration and failure of infrastructure (The Department of Public Works, 2014). Regardless of initiatives such as the Kopanong Precinct Project which was tasked with mass maintenance and refurbishment of government office buildings, infrastructure continues to deteriorate, and buildings are continuously failing to comply with the occupational health and safety standards (Fuchs, 2018; Ndaba, 2019). There is thus an ongoing need in the body of knowledge and in practice for comprehensive maintenance models and frameworks to address the existing challenges.

It is evident that maintenance constructs have been modelled by multiple studies overtime, using Interpretive structural modelling, integration definition for function modelling, business process modelling (BPM) languages, unified modelling language, BPM notation, reliability analysis, fault tree analysis and critical factor analysis (statistical and correlation analyses). The studies include those of Hassanain et al. (2001, 2003), Waeyenbergh and Pintelon (2002), Takata et al. (2004), Márquez et al. (2009), López-Campos and Márquez (2010), Alzaben (2015), Mekasha (2018) and Suresh and Dharunanand (2021). From the identified studies, it is evident that there is a lack of consensus on strategies that influence sustainable maintenance and no clarity on the effective and efficient methodology. The Delphi method was used in this study to determine and validate constructs of sustainable maintenance for government office buildings, especially in emerging economies. Thus, the aim of this book is to determine and validate sustainable maintenance strategies that predict sustainable maintenance for government office buildings in emerging economies.

The following objectives were formulated for this book:

- identify constructs and measurement indicators that predict sustainable maintenance and examine whether the identified constructs and measurement indicators in emerging economies are the same as those in other geographical areas;
- determine maintenance strategy outcome features of sustainable maintenance for government office buildings;
- assess the influence of existing infrastructure policies and acts in emerging economies;
- determine the level of adoption of existing maintenance practices for government office buildings;
- assess the level of involvement of existing stakeholders in the execution of sustainable maintenance for government office buildings; and
- determine the impact of improved awareness on maintenance culture in sustainable maintenance for government office buildings.

The objectives above enabled the determination of key constructs and measurement indicators influencing sustainable maintenance for government office buildings in emerging economies. The objectives also ensured the indication of key maintenance strategy outcome features of sustainable maintenance for government office buildings. From the findings, it was possible to determine and validate sustainable maintenance strategies for government office buildings in emerging economies.

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