

**STRATEGY FOR PUBLIC PRIVATE PARTNERSHIP (PPP) IN NIGERIAN
PUBLIC INFRASTRUCTURE MAINTENANCE.**

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ABSTRACT

Infrastructure provides the foundation of every nation's economy and quality of life, thus investing in aging infrastructure therefore, is essential in supporting healthy and vibrant communities. Inadequate supply, very poor state of available infrastructure coupled with poor maintenance culture of the few existing ones lead to decay and deterioration. This has been adjudged the major hindrance to ease of doing business in Nigeria. Thus, this study was aimed at developing strategies for public private partnership (PPP) in Nigerian public infrastructure maintenance. The study utilised a mixed methods approach adopting questionnaires, interview and observation methods in collecting of data. Simple random sampling was used in the questionnaire survey among the construction professionals, while a purposive sampling technique was used for selecting the participants for the interview. With a response rate of 40.08%, the gathered data were analysed using percentile, mean item score (MIS), relative importance index (RII), regression analysis, and content analysis. The study found that building walls, painted surfaces, toilet facilities, electrical services and floor are the components of building requiring frequent maintenance. Also, public buildings are in bad state, and this condition was attributed to no maintenance culture, and poor budgetary provision for maintenance. The current models for infrastructure maintenance are 'labour only method' and 'direct labour methods'. High life cycle cost, poor quality of maintenance work, weak/little competition in public services, Inefficient risks allocation, and Delay in infrastructure provision, maintenance and additional revenue; are the limitations of the current maintenance system used. The major effects of PPP maintenance model on infrastructure are: PPP Improves/ better Service Quality of maintenance work, PPP maintenance contract will help to prevent sudden breakdown of building component and equipment, PPP ensures More Efficient Allocation of Risk, the use of PPP model will help to Prevent building collapse. It was concluded that PPP has the potential to change the maintenance narrative of public infrastructures. It was recommended to engender the culture of maintenance and adequate budgetary provision for maintenance work.

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CHAPTER ONE

1.0

INTRODUCTION

1.1 Background of the Study

Infrastructure provides the foundation of every nation's economy and quality of life (Bivens, 2014). The construction industry drives and propels building and infrastructure provisions and development. According to Eze *et al.*, (2021), Roads, Rails tracks, bridges, recreational facilities commercial and residential buildings, among others; are infrastructures that were brought about by activities of the construction industry. Globally, successive government of nations makes efforts at increasing the number of building and other infrastructures (Lateef, 2010). Thus, a lot has been achieved in advancing building construction and housing provisions (Khan *et al.*, 2014). Tan *et al.* (2012) averred that with increasing urbanisation and as pressure mounts on existing infrastructures, a number of them ages especially in large cities in capitals of nations. As a result, investing in aging infrastructure is critical for maintaining healthy and thriving communities. This is because these infrastructures need to be maintained.

Nigeria ranks 124th of 140 world economies for "Quality of overall infrastructure" (World Economic Forum, 2017). Also, 'inadequate supply of infrastructure' has in both quantity and quality been cited as the major hindrance to ease of doing business in Nigeria (Rufus and Bufumoh, 2017). Nigeria has a number of laudable infrastructural development projects that makes her seemingly an economic giant in Africa. These projects range from world class standard stadia, international airport facilities, universities, hospitals, schools and the refineries to mention a few. However, most of these public infrastructures have failed to meet up to their performance expectation over

the years, they have ended up in most cases forgotten or abandoned over long periods leading to their poor performance (Bivens, 2014). This begs the question whether these projects were actually intended to perform sustainably as expected since their current state is far below as built standard and can no longer perform as required. It is critical to emphasize that putting facilities in place is not enough; they must also be properly maintained in order to achieve the goals for which they were created (Adenuga, 2012). It is also evident that the only method to maintain a housing stock at any given time is to properly maintain the existing stock (Adenuga *et al.*, 2010a).

The process of protecting or conserving someone or something, or the process of keeping something in excellent working order, is known as maintenance. Building maintenance is defined as the process of preserving or maintaining a building's economic value. Maintenance is defined as "the construction of all technical and associated administrative procedures intended to retain or restore an item to a state in which it can perform its required function" according to BS3811 (1984). Nigeria has one of the lowest maintenance cultures in the world, particularly in our big towns and cities, where the majority of public properties are located (Ojara, 2013). Poor maintenance culture has become a widely acknowledged concern in Nigeria, according to Eti *et al.* (2004), and has had a negative impact on the quality of public properties. Nigerians struggle to preserve their own property and regard public amenities as government property that belongs to no one (Adeleye, 2009). When looking at the relationship between economic development and infrastructure, it's clear that regular upkeep is required (Umar *et al.*, 2014).

According to Odediran (2012), a substantial portion of building tenants perform "servicing." Odediran went further to describe servicing as periodic maintenance activities and stated that it is the predominant maintenance practice in Nigeria. According to Zubairu (2010), most people do this without realizing it because it takes the form of cleaning, window washing, and routine painting and decorating. These servicing maintenance practices though popular, predominant and widely obtainable in Nigeria are inadequate to ensure optimum performance of infrastructure.

An appropriate procurement system selection for projects is a vital ingredient to a comprehensive client and user's (occupants) satisfaction and success of construction projects (Chua *et al.*, 2014).

With regards to maintenance services, regeneration, and property development (Trimmer and Kidston, 2003) defined procurement as the activity of obtaining buildings and properties while considering variables such as price, time, quality and sustainability; in order to deliver best value. According to Masterman (2002), procurement systems could be categorised as integrated, separated, management oriented and discretionary method of procurement. In Malaysia, Chua *et al.* (2014) found that public universities' maintenance are popularly procured using outsourcing by specialist term contract, by tendered schedule term contract, by repair and maintenance contract and by measured term contract. The various methods of procuring maintenance work identified by (Adenuga and Dosumu, 2012) are, traditional contract, measured term contracting, package deals, construction partnering, and prime contracting. In Nigeria, Adenuga and Dosumu (2012) posited that the most common adopted procurement types for maintenance contracts are; direct labor, lump sum contracts,

classic contracts, cost reimbursement contracts and measured duration contracts are some of the types of contracts available.

A new maintenance approach has emerged, as well as updated thoughts on maintenance organization. Using Public-Private Partnerships (PPP) is one of such techniques. The growth of expensive, complicated, and highly developed infrastructure, equipment, and machinery has prompted efforts to improve maintenance concepts in order to achieve improved product quality, longer system life, higher system effectiveness, and operational safety (Al-Najjar *et al.* 2001). According to Usman and Egbewole (2011), a public-private partnership (PPP) is a long-term agreement between a government agency and a business partner for the delivery of products or services, with both sides sharing the risks and profits of the delivery. PPP is a response to the ever-increasing demand for suitable infrastructure as a result of its link to economic growth (Usman and Egbewole, 2011). As a result, private firms have offered this solution in collaboration with the public sector or one of its branches, which provides a more integrated financial design, building, maintenance, and operational solution for managing public infrastructure projects.

In essence, a public-private partnership (PPP) is a form of collaboration between government and the private sector to fund, build, renovate, manage, operate, or maintain infrastructure or services. To supply the infrastructure or service, all PPPs require some sort of risk sharing between the public and private sectors. This thesis is therefore intended to appraise how the application of Public Private Partnership (PPP) models can ensure adequate maintenance of Public infrastructure in Nigeria.

1.2 Statement of the Research Problem

Infrastructure maintenance has been defined as the collection of all actions taken on a regular basis to maintain or restore a property to a usable state (Oladimeji, 1996). Because a large percentage of a nation's wealth is obvious in the total worth of its infrastructure, Nigeria's failing maintenance culture and its effect on buildings has become a big challenge for both the public and private sectors (Oyenekenwa, 2011). Various research studies have shown that the inadequate maintenance practices obtainable in our nation has resulted mainly from ignorance, neglect and poor contractual agreements (Zubairu, 2010). Others are poor handling of project execution by private contractor engaged by the government and poor management to ensure optimum building productivity in its designed capacity as the main challenge to the provision of adequate infrastructure (Zubairu, 2010). The poor maintenance states of public buildings and facilities have remained in appalling states till date. This is evident in the reports of (Ebekoziem, 2021; Abiodun and Adeyemi, 2020; Adenuga, 2011). It is due to the bad state, poor handling and misuse of public and private building by users in Nigeria, that Ogungbile and Oke (2015) suggested a stricter action to forestall public assets and facilities from their 'sorry' states.

The majority of building infrastructure in Nigeria, whether owned or used by the government, businesses, or individuals, is in poor condition, owing to a lack of maintenance culture and comparatively expensive maintenance costs (Usman *et al.*, 2012). It is expected that the government provides adequate infrastructural maintenance

of essential facilities for the benefit of its populace via citizen's payment of taxes. In practice, these levies are insufficient to ensure that these services are given, resulting in a budget shortage for basic services and infrastructure development in both developed and developing countries (Dayo, 2019). The majority of Nigeria's infrastructure is deteriorating and in need of repair, refurbishment, or renewal. The African Development Bank estimates the crippling infrastructure deficit on Nigeria's economic growth at N30tn (Oyedele, 2012). This condition has arisen in part as a result of little or no maintenance when there were small issues, as the government has the primary power to create, improve, and destroy.

The notion of PPP was born out of the government's incapacity to satisfy its responsibilities to supply and maintain infrastructure, as well as the need to control private individuals' contributions to infrastructure development. (Nigeria Infrastructure Advisory Facility, 2017). Studies have shown a lack in resources available to the government for maintaining of public infrastructure. These scarce resources range from the inadequacy of generated taxes to meet the performance need of infrastructure to the lack of expertise where needed to maintain certain facilities (Oyenekenwa, 2011). Furthermore, the current methods of procurement of maintenance work have failed. This is evident in the reports of (Abiodun & Adeyemi, 2020; Adenuga, 2011; Ebekozen, 2021). Ebekozen (2021) reported that maintenance issues of public hospital buildings is centred around improving human development, management efficiency, technical competence and professional skills, and cost-minimisation. Public hospitals and other buildings and infrastructures suffer from neglect and are in appalling conditions (Abiodun & Adeyemi, 2020; Adenuga, 2011). Ali *et al.* (2016) found out

through literature review that public facilities are poorly maintained. This was blamed on procurement methods which are mainly conventional

In the UK, specifically in Scotland, Rizal (2017) found that PPPs provided better and more conducive buildings with better maintenance standards than the conventional procurement system and that PPP funded public facilities offers better value-for-money (VFM) than the conventionally-funded types. Hampton *et al.* (2012) found that PPP procured projects performs better in terms of time and cost, than the traditionally procured projects.

Another reason for the use of PPP by government in provision of adequate infrastructure is that the involvement of the private sector introduces a range of efficient management and maintenance servicing techniques to a sometimes overly bureaucratic or ineffective public sector which should increase value for money and overall quality of the infrastructure (Demirag *et al.*, 2010).

Public private partnership (PPP) can be said to be a bridge in the gap of infrastructural maintenance in Nigeria and this research is to outline the strategies on how the collaboration of the public and private sector via PPP can bring about the successful maintenance of public infrastructures in Nigeria

1.3 Research Questions

1. What is the current state of public building infrastructure in Nigeria?
2. What is the current model for maintenance of infrastructure in Nigeria?

3. What are the limitations to the current model for maintenance of public infrastructure in Nigeria?
4. What are the effects of Public Private Partnership (PPP) maintenance models on infrastructure in Nigeria?
5. What are the strategies of adopting PPP in maintenance of Public infrastructure?

1.4 Aim and Objectives of the Study

The study aims at appraising the potentials of Public Private Partnership (PPP) as a tool in the maintenance of public infrastructure with the view to achieve effective building infrastructure. In order to achieve this aim, the specific objectives are to;

1. Determine the current state of public building infrastructure in Nigeria.
2. Assess the current model for infrastructure maintenance in Nigeria.
3. Investigate the limitations of the current model for maintenance of public infrastructure in Nigeria.
4. Investigate the effect of Public Private Partnership (PPP) maintenance model on infrastructure in Nigeria.
5. Propose strategies of PPP in maintenance of Public infrastructure.

1.5 Justification of the Study

Maintenance of infrastructure is vital to economic stability of developing nations. Its shortfall in Nigeria has been described as economically detrimental (World Economic Forum, 2017). Considering the effect of infrastructural performance on national economy and the deplorable state of our infrastructure largely due to poor maintenance culture, this study will examine the current maintenance activities employed on public

infrastructure in Nigeria in a bid to establish the gap between what is obtainable on the backdrop of the present conditions of these infrastructure so as to propose strategies towards the adoption and use of PPP maintenance standards.

With this study, an evaluation of the state of public infrastructure with regards to maintenance and its quality performance is to be carried out and the possibility of an improvement in its state by the adoption of the universally acceptable PPP model will be examined. These are to be done solely to understand the peculiarities of the deficiency in public infrastructure maintenance and find ways to mitigate its negative effects on various other aspects of our economy.

Data generated from this study will help the various stakeholders to see the extent of decay in our infrastructure and make efforts to curb its excesses. Also, the study will be an eye opener for the various stake holders to see the need for the maintenance of infrastructure which they have abandoned so as to avert the imminent danger that is looming in the sector.

These findings will educate the government and policy makers, stakeholders in infrastructural development and the general public on the need for improvement in maintenance culture and whether through the adoption of PPP models, maintenance and quality of public infrastructure will be improved.

It will also serve as a resource base to other scholars and researchers interested in carrying out further research in this field.

Below is a list of other accruable potential benefits of PPP on maintenance of public infrastructure;

- Keeping assets in utmost working condition in order to minimize downtime and disruption to services.
- Keeping facilities in a state of good repair for the occupant's health and safety.
- Keeping assets from deteriorating in appearance and aesthetics.
- Keeping facilities so as to optimally achieve their full potential service life.
- Satisfying a legislated duty that is owed to owners, occupants and guests on the property.
- Preventing unnecessary damage to assets or facilitation that may result in their performance failure.

A lot of studies exist in extant literature on PPP procurement and maintenance. For instance, In Nigeria, Ebekozien (2021) carried out a comprehensive review of public hospital buildings maintenance in Nigeria. The Procurement methods for executing maintenance work and factors influencing choice of methods used (Adenuga & Dosumu, 2012). The challenges facing projects procured by public private partnership (PPP) (Olele, 2016). In Zambia, Challenges of implementing PPP for road projects (Chilala & Mulenga, 2017). In Malaysia, a comprehensive review of building maintenance issues, their effects and way forward (Ali *et al.*, 2016). Building Maintenance Projects in Malaysia: Choosing a Procurement Method (Chua *et al.*, 2014). Malaysians make cost-cutting decisions when it comes to building maintenance (Ali,

2009). A causal relationship exists between the building maintenance market and GDP in Hong Kong (Tan *et al.*, 2012).

While these studies focused on either maintenance or PPP, none of them examined the role of PPP in bringing about sustainable public infrastructure maintenance. It is based on this gap in literature that this study proposes strategies for PPP in Nigerian Public infrastructure maintenance.

1.6 Scope and Delimitation

This research work covers the appraisal of PPP in Nigerian public infrastructure maintenance in the Federal Capital Territory. The study looked at the quality of these buildings as it relates to the maintenance activities employed on them, the shortfalls in their maintenance and the possibility of bridging the gap with the introduction of the PPP venture while analyzing the benefits and advantages of PPP as well as any possible challenges it might pose. The work involved various stake holders in the building industry including PPP administrators, Architects, Engineers, Builders, Quantity surveyors, Facility managers, Contractors and building occupants.

1.7 Definition of Public Private Partnership (PPP)

Arrangements between governments and private sector firms for the purpose of providing public infrastructure, community facilities, and related services have been classified as a public-private partnership. Such partnerships are defined by the partners' share of investment, risk, responsibility, and return (British Columbia Ministry for Municipal Affairs, 1999). A public-private partnership is also characterized as a

cooperative enterprise in which the risks associated with providing public services are shared between the public and private sectors (Usman and Egbewole, 2011).

Maintenance has been defined as “the construction of all technical and associated administrative operations intended to keep or restore an object to a state in which it can perform its specified function,” according to BS3811 (1984).

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Maintenance of Infrastructure

Maintenance is an important aspect that influences the long-term profitability of infrastructure, and it is becoming increasingly crucial (Kelly, 2014). It is vital to have clear definitions of this comprehensive discipline in order to fully appreciate the concept.

Maintenance is the sum of all technical, administrative, and managerial actions taken during an item’s life cycle in order to keep it in, or restore it to, a state where it can perform the required function. Maintenance is defined by Duffuaa *et al.* (1999) as a set of operations that keep or restore equipment or a system to a state where it can perform its intended duties.

Product quality is influenced by maintenance, which can be used as a competitive strategy. As a result, in order to produce high-quality products, industrial plants and equipment must work within parameters that may be met through timely maintenance (Zeeshan, 2020; Designing buildings wiki, 2021).

Maintenance is therefore an important business support role, especially as big investments in physical assets become more common. According to Komonen (2002), industry maintenance has two primary goals: high availability of production equipment and low maintenance expenses. These goals, as well as the indirect impact of maintenance on an organization's financial success, have been explicitly defined.

The long-term viability of any nation's capital investments has been a major topic of discussion around the world, particularly in emerging countries where infrastructure development is still in its infancy (Ojara, 2013). This is because the majority of government expenditures and investments are focused on infrastructural development such as roads, power, water, and housing, despite the fact that sustainability is a major concern in industrialized countries.

Several governments place a high priority on awarding contracts for new infrastructure while paying little attention to maintaining old infrastructure. The preservation of the current stock of infrastructure facilities and services is one of the variables that contribute to infrastructural sustainability (Ojara, 2013).

Ojara, (2013) assessed the state of several amenities, including kerosene cooking, flush toilets, generators installations, well water, gas cooking systems, bath facilities, in-house portable tap water, public portable tap water, private bath facility, public bath facility, electricity cooking system, spring and stream, pit latrine, and pail system.

Maintenance, according to BS 3811 (1974), is “work or a combination of actions connected with initiation, organization, and implementation carried out to retain or restore an item to an acceptable standard in which it can perform its needed function”.

As a result, Kunya (2012) noticed flaws in housing facilities. Peeling of the wall surface, growing dampness in the substructure, floor slab failure, doors and windows fault, leaking roof, foundations failure, and beam sagging were all listed by Kunya (2012). It was also suggested that, in order to maintain utility, maintenance culture necessitates accurate fault diagnosis, current remedial measures, sound technical understanding of material usage, managerial resources, and the design and implementation of integrated plans and policies. The lack of these attributes has resulted in the physical, social, aesthetic, and economic environment of the country deterioration.

2.1.1 The problem with maintenance of infrastructure

The use of untested or inferior materials such as cement, aggregate, and water, incorrect facility management such as door locks and louver, a lack of frequent facility inspection, a poorly constructed fire suppression system causing un-insulated (PVC) pipes to freeze and break, and a lack of experienced professionals are among the causes of flaws in housing facilities as highlighted by Ipingbemi (2010). He went on to say that the focus was on the development of new properties, with little attention paid to existing stock or the prospective ones' future maintenance requirements. Housing maintenance gets increasingly complex as the structure ages, and this is dependent on the original building's conditions as well as the structure's pace of upkeep (Adenuga, 2012).

It's worth noting that the goal of maintenance is to keep buildings in their original functional, structural, and aesthetic states. This is to ensure that they remain in such a high quality state and keep their investment worth for the course of their lifespan (Ipingbemi, 2010). Users do not always use the property and services in excellent

working order, and they frequently disregard the advice provided in the building's maintenance manual, assuming one exists at all.

Several property owners try to keep maintenance costs as low as possible in order to avoid the long-term consequences of their actions. Designers may overlook the materials' durability and use before incorporating them into their designs (Adejimi, 2005). Kunya (2012) highlighted some remedies to the highlighted flaws, including the availability of qualified and competent artisans, proper maintenance of the building facility, such as door locks, inspection of building materials prior to use, frequent facility check-ups, and the usage of tested products.

2.2 Public Private Partnership (PPP)

A long-term contractual agreement between a government agency and a commercial partner for the delivery of goods or services is known as a public-private partnership. As partners, every stakeholder shares the possible risks and advantages that come with delivering goods or services, such as financial risks and responsibilities, as well as quality assurances for the taxpayer. Because the government organization involved in the agreement retains management and ownership of the project, public-private partnerships are not privatizations. A public-private partnership's purpose is to enhance the provision of appropriate infrastructure in a region or specific place, which is, of course, essential to provide for citizens and/or supplementary development, and which can be accomplished via a range of public-private partnership models (Nigeria Infrastructure Advisory Facility, 2017).

Infrastructure development is perhaps the single most significant component for economic development, as infrastructure facilities are the wheel that drive any economy and create the enabling environment for long-term economic growth and wealth creation (Usman and Egbewole, 2011).

It is unarguable that Nigeria has a significant infrastructure deficit, and that the infrastructure that is available is not being utilized to its full potential. The World Bank recommends that emerging countries like Nigeria invest 7-9 percent of their GDP in infrastructure (Babatunde, 2018; Obi-Anike *et al.*, 2020).

Given the foregoing, it is clear that the government, even in the best of circumstances, cannot afford to supply the infrastructural necessities required for a country's economic development, necessitating the involvement of the private sector. As a result, public-private partnerships are an essential and crucial tool for achieving long-term economic development (Patil & Laishram, 2016).

2.2.1 Importance of public private partnership (PPP)

The justification for undertaking projects such as e-government and ICT is persuasive in most countries. Modernization, new technologies, more efficiency, and better services for people and customers are required at all levels of government. However, many of the essential adjustments and modernizations are not only capital intensive and costly, but also difficult to manage and outside the scope and skill set of most government agencies (Usman and Egbewole, 2011). A potential "win-win" solution can be realized by having the private sector perform an e-government or ICT service on behalf of the government, in which the private sector finances and operates a system, the government

is in a better position to "ensure" effective delivery of the service, and the customer/citizen receives a higher quality service and is more constructively engaged in customer introspection.

Sustainable access to healthcare and other socioeconomic services and products in Nigeria and other developing nations can be achieved through public-private partnership, in which the government provides the minimal standard of services, products, and or care, the private sector provides skills and core competencies, and donors and businesses provide funds and other resources. Such partnerships will be especially beneficial in promoting poverty alleviation through microfinance, as well as improving health through partnerships, s has been the case with polio eradication and other child immunization programs (Usman and Egbewole, 2011).

The importance of PPP in society cannot be overstated, as it is beneficial in nearly every facet of life. For example, PPP can be beneficial in high-priority projects since it helps to speed up the implementation of projects for which the administrations lack funding. PPP also encourages very speedy and low-cost provision. PPP is all-encompassing since it may be used in economic solutions to help promote economic growth through private sector investment (Obi-Anike *et al.*, 2020).

2.3 Public Private Partnership (PPP) and Maintenance of Public Infrastructure

Most developed nations have very well planned out maintenance programme; it is recognised that well maintained infrastructures plays a great role in the socio-economic development of a nation (Ugwu *et al.*, 2018). Because these countries invest in infrastructure and rely on it as a source of revenue, upkeep is a top priority. According

to Cobbinah (2010), infrastructures are used in Dubai to attract tourists and this brings revenue to the country. Nigerians troop to countries like Japan, France, South Africa, United Kingdom, USA, Australia, New Zealand, among others because they have adequate and well developed and maintained educational buildings. This brings a lot of capital flight and revenue to these countries (Cobbinah, 2010).

Adenuga *et al.* (2006) has attributed the continuous decay of public infrastructure to poor funding, abuse and misuse of facilities by occupants, bribery and corruption among other vices. Construction projects in Nigeria are worth billions of Naira and the emphasis is on construction management practices instead of maintenance (Ugwu and Attah, 2016). This has a negative effect on the management of public infrastructures. Furthermore, Cobbinah (2010) pointed out that public buildings and infrastructures are left to decay to a deplorable level before maintenance is planned, thus, leading to economic loss and durability issues. In most cases, structures are left without any form of maintenance which most times lead to total overhaul and reconstruction; the consequence is serious economic wastage.

Oyigbo and Ugwu (2017) observed that many public institutions carry out infrastructure development through PPP but measurable indicators to success or otherwise do not exist. Thus, with the huge deficit of infrastructure in many economies of the world especially in this modern period, the public private partnership model has been advocated to be the best approach to procuring and maintaining public infrastructure. This is because this system is regarded as being radically different from traditional procurement (Pirvu and Voicu-Olteanu, 2009). Cobbinah (2010) defined maintenance

as every action taken to preserve an infrastructure in its original state so that it will retain its economic value and durability.

There are two types of maintenance according to BSI (1984). These are: planned and unexpected. Preventive, corrective, and emergent maintenance are all part of planned maintenance. We have scheduled maintenance and conditioned maintenance under preventative maintenance. Unplanned maintenance, on the other hand, consists of corrective/emergence maintenance.

Different types and forms of public-private partnerships exist. According to Zakari (2007), PPPs can take various forms and patterns depending on the partnership's goals and objectives, the kind, nature, and characteristics of the stakeholders and beneficiaries, the type of contractual agreement and policies adopted, and clearly defined shared responsibilities and sources of financial and material support to ensure growth, sustainability, and improved ret in these PPP arrangements, the public and private parties share responsibilities and risks in different ways. The terminology listed below are frequently used to characterize typical infrastructure maintenance partnership agreements (United Nations, 2008).

[1] Operations, Maintenance and Management (OMM):- A commercial partner contracts with a public partner (federal, state, or local government agency or authority) to operate, maintain, and manage a facility or system that provides a service. The public partner retains ownership of the public facility or system under this contract option, but the private party may spend its own capital in the facility or system. Any private investment is thoroughly assessed

in terms of its contribution to operational efficiencies and cost savings over the contract's duration (Service Work global, 2019; The constructor, 2019).

[2] **Design-Build-Finance-Operate-Maintain (DBFOM):-** The Design-Build-Finance-Operate-Maintain (DBFOM) strategy bundles and transfers the responsibility for planning, building, financing, operating, and maintaining to private sector partners. In the United States, DBFOM arrangements vary greatly, particularly in terms of the extent to which financial responsibilities are actually passed to the private sector. One thing that all DBFOM projects have in common is that they are financed in part or entirely by debt leveraging revenue streams devoted to the project. The most prevalent revenue source is direct user fees (tolls). Others, including as leasing payments, shadow tolls, and vehicle registration fees, are not included. Future revenues are used to finance capital and project development expenditures by issuing bonds or other debt. They are frequently reinforced by government grants in the form of cash or in-kind donations, such as right-of-way. Private partners may be needed to make equity contributions in some situations. Life-cycle costing can help you get the most bang for your buck (Service Work global, 2019; The constructor, 2019).

[3] **Design-Build-Operate-Maintain (DBOM):-** The design-build-operate-maintain (DBOM) model is an integrated partnership that combines design and construction tasks with operations and maintenance duties in design-build procurements. These project components are purchased from the private sector under a single contract with public-sector finance. Through the contract's

conditions, the public agency retains ownership and a large amount of management of the activities (Service Work global, 2019).

[4] **Design-Build-Finance-Operate-Maintain-Transfer (DBFOMT):-** The Design-Build-Finance-Operate-Maintain-Transfer (DBFOMT) partnership model is similar to the DBFOM partnership model, except that the private sector retains the asset until the end of the contract, when ownership is passed to the public sector (Service Work Global, 2019; The Constructor, 2019).

2.3.1 The current state of public infrastructure in Nigeria

The foundation for every country's productive activities is the Public infrastructure; thus, the establishment of mass housing, telecommunication facilities, water works, power plants and distribution systems, and road and rail networks and facilities are critical inputs for the production of national goods and services (Rioja, 2012). He further stressed that the number of public infrastructures of a country is as importance as the condition of the infrastructures. These infrastructures with use and as time passes, get worn out; thus necessitating proper and apt maintenance which could be periodic.

According to Rioja (2012), the continuous neglect and poor maintenance of public infrastructure ultimately lead to deterioration and weakening of the condition of infrastructure. This result to potholes in roads, low and dropped phone calls, persistent power outages, continues loss of irrigation water among others. The short and long term implication of poorly maintained infrastructures are; it leads to/ and impose cost on the

users of the facilities, leads to higher cost of re-building, health issues could also develop, poor morale of workers, among others (Ugwu, *et al*, 2018).

In Nigeria, it has been found that 80% of the public buildings requires one or more maintenance work (Ugwu *et al.*, 2018). It was also confirmed that public buildings are in very terrible conditions, needing both structural and decorative repairs attention (Odediran *et al.*, 2012); Ugwu *et al.*, 2018). Nigeria's infrastructure report, like that of any other third-world country, is nothing to write home about (Oyedele, 2012). Both numerically and qualitatively, public housing is in a bad situation (Ajanlekoko, 2001; Oyedele, 2006). Oyedele (2012) also asserted that the bulk of facilities have degraded and require repair, rehabilitation, refurbishment, or replacement. This is the state of public infrastructure despite successive government efforts at repositioning the underdeveloped economy like Nigeria. Successive government has invested a very large chunk of the country's human and financial resources, challenged the development of transportation Infrastructure, Government administrative Buildings for ministries and Parastatals, public institutions of learning (primary and secondary schools, Colleges of Education, Universities, polytechnics and research institutes) (Eke *et al.*, 2017).

Public infrastructures are allowed to deteriorate and decay as soon as they are commissioned, this results from insensitive stance of key stakeholders to Billions of Naira and dollars spent in erecting such infrastructures (Adenuga, 2010a; Adenuga, 2010b; Ugwu *et al.*, 2018).

Ugwu *et al.* (2018) confirmed that public infrastructure maintenance is a huge problem bedevilling public buildings and structures. This was attributed to the lack of integration

of maintenance plans in the planning, design, construction, operation and use of public facilities. Ugwu *et al.*, (2018) reported that virtually all the parts and elements of the public buildings studied require one maintenance or the other. It was reported that maintenance work is required in the plumbing and electrical installations, doors and windows, roof, walls, ceiling and floors. According to Eke *et al.* (2017), to ensure the sustainability of these various infrastructure, enough attention should be given to the maintenance of these infrastructure. For safe operations and overall performance, facilities must be properly maintained and rehabilitated on a timely basis (Adnan *et al.*, 2012).

2.3.2 The current model for infrastructure maintenance in Nigeria

Odediran (2012) specified that a larger chunk of building occupants undertake maintenance work in the form of ‘servicing’ on daily, weekly, monthly, quarterly, and yearly basis. This is done in the form of cleaning, washing of windows, regular painting and decoration. Furthermore, Olatunji *et al.* (2016) reported that the current model of carrying out maintenance in Nigerian public buildings are through contracting methods and direct labour methods which are both traditional in nature. It was further stated that regardless of the methods used, the form of maintenance is usually through servicing, rectification, replacement and renovation. In the contracting method, the contractors are selected on a negotiated basis which attract more cost and can house corrupt practices. Both the contracting methods and direct labour methods are traditional ways of procurement. It was emphasized that the sizes, cost, quality, types and number of buildings to be maintained has influence on the model to choose (Adenuga, 2012;

Olatunji *et al*, 2016). Davis *et al*. (2008) explained that the traditional approach allows a separation of design from construction, operations and maintenance. The direct labour system allows public agencies to directly hire and supervise trades-persons, labourer, plant and purchase materials and equipment's to carry out both building and maintenance work; this is directly undertaken by the works or maintenance department (Ojo, 2009; Adegoke, 2010). During the colonial time, the direct labor system was deemed to be the primary procurement method employed in Nigeria for completing construction projects Ojo *et al*. (2006). Because construction costs in Nigeria are higher than in other nations, the government and its agencies have recently opted for the direct labor approach (Adegoke, 2010). It was discovered that public clients favours the use of direct labour system than the private clients; as no record of the use of this system by private sector (Adegoke, 2010), thus, public infrastructures are built and maintained through this method.

2.3.3 The limitations of the current model for maintenance of public infrastructure in Nigeria

Ugwu *et al*. (2018). Lack of an operational maintenance policy, insufficient funding for maintenance, poor execution of maintenance work by designated accountable units/agencies, corruption, a lack of skilled staff (human capacity building), occupant misuse of facilities, and bad architectural drawings/designs are all obstacles to maintenance. The current methods of procurement of maintenance works has a lot of limitations which has triggered the call for the use of modern techniques like PPP. According to Adegoke (2010) the limitations of this system of procuring maintenance

work are, lack of skilled labour, more expensive and lastly, hard to recall people should there be emergency. Other limitations include;

- i. The procurement route is sequential and longer, this impacts on the project duration. Maintenance project procured through this method usually takes a longer time to start work on site.
- ii. Some failures emanate from poor design and planning. Contractors are not allowed to take part in the design and planning of most public infrastructure
- iii. Full contract documentation must be made before work can begin on site.
- iv. Owing to the length of time it takes to finalise procurement process, this method is costly and time consuming
- v. All labour, plants and materials risks are born by the clients as the contractors may be small and inefficient
- vi. Because there is no price competition in the tendering process, determining the cost and time outcome/output is challenging.
- vii. Client may not get value for money.
- viii. In case maintenance requires redesigning, the client is faced with design risks and management which attract additional cost risks.

2.3.4 Effect of public private partnership (PPP) maintenance model on infrastructure

A public-private partnership (PPP), according to Dabak (2014), is a contractual agreement between the public and private sectors in which the private operator offers services that were previously completed or supported by a public entity. PPPs' ultimate goal is to provide more "value for money" and "proper risk transfer" than traditional

public procurement methods. Although determining expected value for money in advance is typically difficult, a PPP can be said to provide value improvements if it produces/achieves the following effects, benefits, and advantages:

1) Reduced life-cycle costs

Reduced life cycle costs because the private sector is better able to provide asset operation and maintenance at low costs through the asset's entire life cycle, which is fundamentally difficult to achieve under the limits of typical government budgeting.

2) More efficient allocation of risk

Better risk allocation - allocating risk to the party best able to manage it at the lowest cost is a basic principle of any PPP. The goal is to optimize risk transfer rather than maximize it in order to get the best value.

3) Faster implementation

Faster implementation as a result of the private sector's design and construction responsibilities;

4) Improved/better service quality

Better service quality as a result of: improved service integration with supporting assets and economies of scale;

5) Payment linked to performance

Payments are connected to the availability of a desired item or service, giving a major incentive for the private sector to complete capital projects in less time.

6) Incentive/motivation to deliver

The transfer of project risk provides a private sector contractor with a better incentive to improve its performance on each given project. In most PPP projects, the private sector contractor will only be paid in full if the required service criteria are met on a regular basis.

7) Better public sector efficiency

Enhanced public sector efficiency as a result of:

- a. The transfer of responsibility for providing public services to the private sector, which relieves government employees of the burden of regulating, service planning, and performance monitoring rather than managing day-to-day delivery of public services.
- b. Opening up public services to competition, allowing costs to be benchmarked to market norm and assuring value for money.

8) More competition in public service

Performance incentives and penalties typically included within a PPP contract.

9) Acceleration of infrastructure provision and additional revenue

Infrastructure provision should be accelerated by obtaining private finance for organizations with constrained public capital budgets. As a result, much-needed infrastructure expenditures can be made sooner.

When the net advantages from PPPs are greater than the corresponding net gains from traditional public provision, the private provision of a public service is socially beneficial when contrasted to in-house delivery by the public sector. The following relationship, in a nutshell, must be true:

PPP *net allocative* efficiency gains + PPP net productive efficiency gains > gains with public provision.

2.3.5 The framework for PPP in maintenance of public infrastructure

If governments intend to rely heavily on the PPP model for new infrastructure construction and maintenance, they need take a systematic and systematic approach. The PPP framework should aim to support the jurisdiction's PPP program's effective, efficient, and long-term delivery. A PPP framework is a means to an end, not an end in itself. If a jurisdiction only intends to conduct one PPP project, it makes little sense to establish a complex PPP structure (Treasury, 2012). Similarly, a government using PPPs to fund the speedy construction of badly needed infrastructure may establish a framework that emphasizes speed and capital attraction. A government that uses PPPs to promote efficiency and accountability in a well-funded sector would most likely create a different structure. The first stage in building a framework for the use of PPP in infrastructure maintenance would be to identify the project's goal. These goals will provide the framework's stakeholders with the guidance they need to develop acceptable processes, decision criteria, and institutional duties (World Bank group, 2019).

The objectives chosen are determined by the government's goals and priorities. They may consist of the following:

- a) Increasing project financing options to enable more investment in infrastructure development and maintenance;
- b) Achieving Value for Money in the provision of infrastructure and public services;

- c) Improving accountability in the provision of infrastructure and public services;
- d) Harnessing private sector innovation and efficiency.
- e) The need to ensure health safety of occupants of public buildings.
- f) Reduction of economics losses by implementing regular and consistent maintenance of public services.
- g) Stimulating the country's growth and development.

2.4 PPP Models Used in Maintenance Work

Operations, Maintenance and Management (OMM) is a type of public-private partnership in which a public partner (federal, state, or local government agency or authority) contracts with a private partner to operate, maintain, and manage a facility or system that provides a service. The public partner retains ownership of the public facility or system under this contract option, but the private party may spend its own capital in the facility or system. Any private investment is thoroughly assessed in terms of its contribution to operational efficiencies and cost savings over the contract's duration. (Service Work global, 2019; The constructor, 2019). According to World Bank Group (2020), "Operation and Maintenance Agreements are project finance documents that establish a contractual relationship between the project company and a professional management company to operate and maintain the project". Like in other variants of PPP, the private party is faced with a strong incentive to carry out adequate maintenance, and ensure that the facilities are always available for use and are in acceptable standards.

Operations, Maintenance and Management (OMM) have proved to be effective in improving the maintenance of assets and their functionality, especially in the road and water, rails and power projects. Pressures on government budget have impacted on the amount set aside for maintenance of public facilities. This has contributed to delayed maintenance of assets. The proponents of PPP have maintained that PPPs provide a degree of certainty and discipline that adequate and timely maintenance will be carried out. Private partners are contractually bound to maintain assets and the public procuring entity has the contractual obligation to for the services. PPPs present stability in long-term operating costs and the private partner is required to bear the risk of costs escalating faster than an agreed indexation provision. This further encourages and propels the private entity to be conscious and vigilant in ensuring that preventive maintenance is carried out routinely and as planned and schedule. Thus, avoiding or minimising the more expensive emergency repairs or maintenance (European PPP Expertise Centre, 2015).

PPP requires that payment is based on performance of the private entity under the contraction provisions. Performance-based measurement aids in ensuring long-term consistency in the level and quality of services provided. Also it has helped to improve asset maintenance over a long term period. The Performance-based measures of PPP in road contracts have proved successful in improving the quality of road maintenance in many countries. Road is a public infrastructure and its maintenance is a pervasive problem in many countries of the world.

Operations, Maintenance and Management (OMM) for example has successfully been applied in Chad, Argentina, Brazil, India, Australia, some UK

countries and USA. In Chad, a 441 Kilometres of unpaved road was awarded under PPP for its maintenance. This was motivated by poor design of maintenance contracts and lack of domestic funding. This road has met and exceeded its performance standard (PPP knowledge lab, 2018). In Argentina, PPP has saved the government up to 30% additional capital expenditure on road rehabilitation. This is because the private entity maintained the road to a specific standard agreed with government and the road standard has improved.

The benefits associated with OMM model of PPP in road and water projects could also be extended to building of public nature. Road and water projects are usually provided by the public and they are normally capital intensive. Their maintenance becomes very essential to improve their durability and stability. Nigerian government can adopt OMM PPP variant, as a lot of failures and poor maintenance of public facilities and buildings have be widely reported. Recently, The Federal Road Maintenance Agency (FERMA) and ICRC have shared experiences on the successes recorded in India and other countries on the use of maintain operate transfer (MOT) PPPs for road maintenance management. “Under the MOT PPP model, the operation and maintenance of a road is given as a concession to a private entity for a definite concession period” (Elisha, 2018). The MOT has the same basic principle as the BOT. However, in MOT in highway, the contract is confined to only operation and maintenance. The MOT PPP scope according to the report of (Elisha, 2018) includes;

- i. Operation and maintenance of road section
- ii. Construction of road infrastructures like signage, street light, rest area, bay
bys, among other.

- iii. Provision of ambulances, clinics, recovery vehicles and other emergency management systems
- iv. Any other major maintenance works, as may be necessary.

This study intends to appraise the suitability of PPP in the maintenance of Public infrastructures (buildings) in Abuja, Nigeria.

2.4.1 Challenges of PPP

Notwithstanding the enormous benefits of public-private partnership implementation in infrastructure provisions and maintenance, the concept is growing in popularity and acceptance (Adebanjo and Mann, 2000). Although, the failure of PPP projects and decline in implementation in some climes have been widely reported. Jamali (2004) identified some of the reasons for the failures as; Lack of government commitment, bad risk management policies, weak banking policies and loan inaccessibility, poorly constructed regulatory and legal framework, insufficient mechanism to attract foreign investors and local private sector participants, and a lack of transparency and competitiveness.

Conflict of interest among partner organizations, diversity of underlying aims among partner organizations, power balance insurance, communication obstacles among partner organizations, difficulties in resource commitment, and vague definition of contracts and agreements are among the obstacles of partnership, according to Mittal and Kalampukah (2009). PPP ventures, according to Edwards (2010), encounter obstacles such as high upfront costs, high procurement costs, insufficient expert knowledge, citizen rejection, and public criticism. Olele (2016) in Nigeria found that

“the Lekki Toll Road Infrastructure Project”, faced similar challenges like what Edwards reported in 2010. These challenges include; high upfront cost, high procurement cost, and stakeholder engagement and management, inflation.

Chilala & Mulenga (2017) In Zambia studied the challenges of PPP in the provision of road infrastructure and reported that; “Concessions' non-financial viability due to low traffic volume, a lack of time, resources, know-how, and authority among the staff of implementing agencies to develop and operate PPPs, The key problems of PPP implementation are inconsistency and ambiguity in PPP policy, lack of long-term financing, PPPs taking too long to materialize, lack of interest by the private sector to implement PPP projects, low interest from the private sector to embark on PPP projects due to the unstable economic environment, lack of finances and treasury permission, and low political commitment.

2.4.2 Measures for overcoming the challenges of PPP

Various measures have been proposed by Mittal & Kalampukah (2009) for overcoming the challenges of PPP projects, and they are;

1. Creation of Open and Informal Communication channel amongst the PPP Organizations
2. Development of clear Project scope and Charter
3. Develop a holistic and comprehensive list of risks Management Sharing Plan and clear definition of roles and responsibilities.
4. Proper Commitment of Resources by Partners should be ensured.

The European PPP Expertise Centre (2015) highlights some possible measures for overcoming the challenges of PPP. The success of PPP is dependent on;

- i. a strong, stable and visible political commitment to implementing PPPs.
- ii. developing an appropriate legal framework.
- iii. institutional frameworks should be strengthened.
- iv. effective communications management and public acceptability of PPPs.
- v. The capacity and capability of the public sector should be strengthened
- vi. Adequate management of the PPP processes
- vii. Shortening of the length of time in preparing PPP projects
- viii. The use of a well-informed private sector partners

2.5 Infrastructure and Building Maintenance

Maintenance is defined as "work conducted in order to keep or repair every facility, i.e. every part of a site, building, and contents to an acceptable quality," according to BS 3811 (1964)". Maintenance, as described by the Department of Environment (1972), is "any activity or effort conducted to improve any facility, i.e. every part of a building, its services, and environs to a currently acceptable standard and to maintain the utility and value of the facility." ". The process of making sure those buildings and other assets is at their best of optimum operational efficiency while retaining their appearance is known as maintenance (Designing building wiki, 2021). Poor maintenance leads to decay, reduced performance and degradation of buildings, which ultimately impact on the safety of occupants and the surrounding facilities.

No infrastructure can be said to be maintenance free, but depending on the design, workmanship, quality of materials, location and functions, the maintenance level can be minimised. Infrastructures and other assets are regularly inadequately maintained. The reason for this is either poor planning of maintenance or deferred planned maintenance. IMF analysis of corruption in infrastructure report showed that greed by leaders and politician are biased towards maintenance of existing assets and infrastructures but prefer to initiate new infrastructure expenditure (PPP Knowledge lab, 2018). Poor maintenance increases life-cycle cost while reducing benefits. Regular maintenance is the lower-cost method of keeping infrastructures assets to an acceptance and serviceable standard.

2.5.1 Design and construction stages considerations

Bearing in mind that maintenance work starts immediately after practical completion of work. At the design and construction stages, there are factors to put into considerations as regards maintenance of infrastructure. These according to The Constructor (2021) are:

- i. Choice of material; the right choice of building materials should be made
- ii. Construction techniques; a suitable construction technique should be selected.
- iii. Proper construction and installation work specification
- iv. Proper supervision of work (construction and rectification) prior to final certification
- v. With proper design, adequate space should be provided for landscaping

2.5.2 Importance of building maintenance

The importance of maintenance on buildings, infrastructures and built assets as summarised from (Designing building wiki, 2021; The Constructor, 2021; Zeeshan, 2020) are;

- 1) Maintenance work prevent buildings and other assets from decay and degradation.
- 2) Improve structural stability and safety.
- 3) Prevent the damaging effects of weather and/or general usage.
- 4) Establishing the causes of defects helps to prevent future occurrences.
- 5) Ensure performance optimisation.
- 6) Ensure that building meet and continues to comply with statutory requirements.
- 7) Restoration of facilities to original standards.
- 8) Assist in the development of plans for refurbishment, renovation, retrofitting or new structures.
- 9) Preservation of buildings and other assets in sound conditions.
- 10) Improves assets life and performances.

2.5.3 Type of maintenance work

Hupjé (2020) classified maintenance into preventive and corrective maintenance. InterplayLearning (2020) categorised maintenance into; preventive Maintenance, Condition-Based Maintenance, Predictive Maintenance, Corrective Maintenance, and Predetermined Maintenance. For Designing buildings wiki (2021), maintenance is categorised into planned maintenance, preventive maintenance, corrective maintenance, front-line maintenance, proactive maintenance, reliability centre maintenance, and scheduled maintenance. According to Zeeshan (2020), building maintenance is

classified into routine maintenance, preventive maintenance, and remedial maintenance/measure or repair.

2.5.3.1 Preventive maintenance

This is a type of maintenance that is carried out prior to the occurrence of damages of failure. It is carried out on a regular basis, and it is meant to improve the strength and structural stability and quality of a structure (Zeeshan, 2020). It is the most commonly executed form of maintenance and it usually occurs many time per year. Examples are replacement of broken roofing tiles, cracked tile, among others.

2.5.3.2 Corrective maintenance

This is a type of maintenance carried out after a building or part or its element is broken or managed. Examples are broken window glass, roof gutter, etc. According to Interplay Learning (2020), this type of maintenance occurs when a problem is identified while working on another work order. Issues are caught ‘just in time’ with corrective maintenance.

2.5.3.3 Front-line maintenance

Sometime a building will be in use while maintenance work is being carried out. Example of such work is repainting and decoration of already occupied structures (Designing buildings wiki, 2021).

2.5.3.4 Proactive maintenance

This is a type of maintenance carried out to identify defects that can lead to failure. Usually, they are done to avoid failure (Designing buildings wiki, 2021).

2.5.3.5 Reliability centred maintenance

This type combines strategies of maintenance to ensure that assets can perform their functional requirement while maintaining their physical appearance (Designing buildings wiki, 2021).

2.5.3.6 Scheduled maintenance

This type is carried out based on predetermined programme. Usually, at intervals, hours run, number of operations/use, among others (Designing buildings wiki, 2021).

2.5.3.7 Remedial maintenance

This is a repair or maintenance work carried out to remove any decayed or damaged part. Sometimes, decay and damages may still occur even after preventive measures. Remedial action would be needed to ameliorate such decay (Zeeshan, 2020).

Hupjé (2020) further categorise preventive Maintenance into five other type, and these are risk based maintenance, predictive maintenance, time based maintenance, condition based maintenance, and failure finding maintenance. Furthermore, corrective maintenance was broken down into deferred corrective maintenance and/or emergency maintenance.

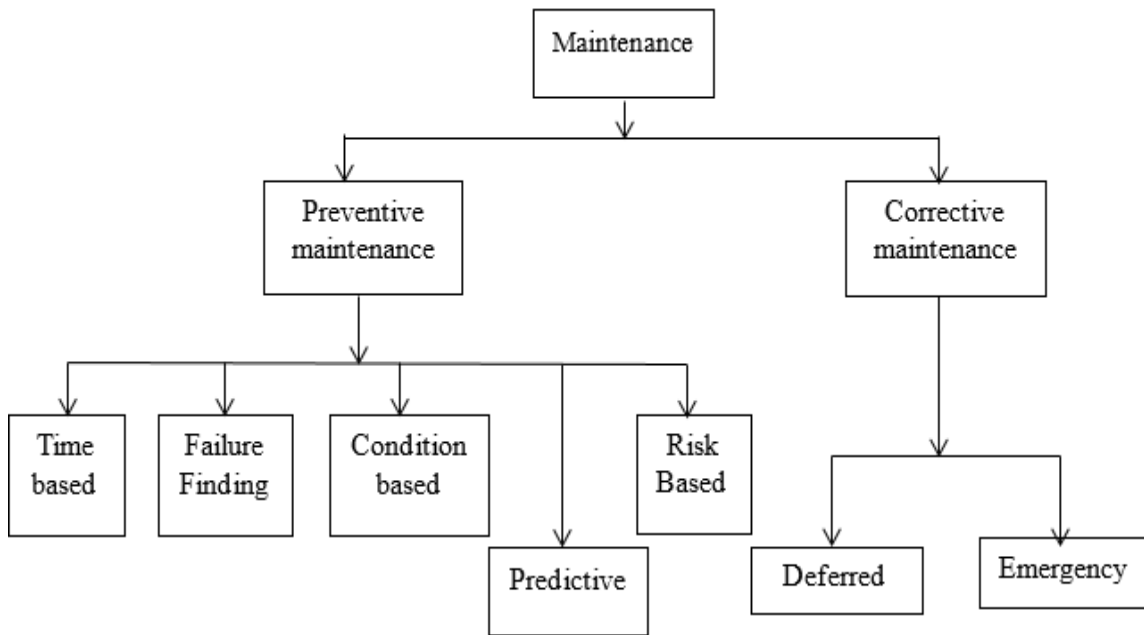
- i. **Time-Based Maintenance (TBM):** this type of maintenance according to Hupjé (2020) involves the replacement of or renewing of items or elements to restore their reliability at fixed time or intervals notwithstanding the conditions.
- ii. **Failure Finding Maintenance (FFM):** this type of maintenance aims at finding hidden failures naturally inherent with proactive functions. For instance,

pressure valves, trip transmitter, and the like. Used majorly for equipment that has hidden failure modes.

- iii. **Risk Based Maintenance (RBM):** used for high risk assets. It involves the use of risk assessment methodology to assign scarce resources to maintenance work on those assets that have high risk level. Equipment with high risk and high consequences of failures are usually subjected to more frequent maintenance and inspection exercises.
- iv. **Condition Based Maintenance (CBM):** is a strategy that involves looking for physical evidence that an asset or building is about to fail is occurring. It is clear that not all failures are age related. Often, failure shows signs before they occur, and early identification of the sign is a key to preventing their damage or failure or their consequences (InterplayLearning, 2020; Hupjé, 2020).
- v. **Predictive maintenance:** this is a type of maintenance in which systems are regularly being observed using sensor devices. It is an extension of the condition-based maintenance type. Sensor devices are attached to components and the conditions of the system is constantly being capture, recorded and transferred in real-time to the central software. The interpretation of data is then carried out by the system, and the maintenance teams are warned of impending danger (InterplayLearning, 2020; Hupjé, 2020). This type of maintenance involves data interpretation by sensor devise, and it is therefore recognised as the most advanced and intensive maintenance type.
- vi. **Emergency Maintenance:** this is a type of corrective maintenance that is so urgent that it distorts the weekly schedule or planned actions. It is the type of

maintenance that is most avoided because it is usually very expensive and unplanned. Around less than 2% of world class organisations' maintenance is Emergency maintenance (Hupjé, 2020).

The types maintenance is summarised in figure 2.1



2.6 PPP Model Suitable for a Type of Maintenance

An operation, Maintenance and Management (OMM) or MOT is the most suitable models of PPP for infrastructure maintenance and management. This is based on the success stories from other climes (developed and developing countries). Also, the benefits outweigh the limitations of PPP. PPP arrangement ensures that the private entity is proactive in its approach to maintenance contracts. This makes it possible to avoid or minimise the more expensive emergency maintenance European PPP Expertise Centre, 2015) The incentive to perform under the PPP makes private sector partners to

Figure 2.1: Summary of the types of maintenance

be vigilance in making sure that failures or damages or decays are avoided by

proactively following the planned and /or routine maintenance to prevent such deterioration. Therefore, preventive maintenance is better suited to the OMM or MOT PPP for carrying out infrastructure maintenance contracts. This further encourages and propels the private entity to be conscious and vigilant in ensuring that preventive maintenance is carried out routinely and as planned and schedule. Thus, avoiding or minimising the more expensive emergency repairs or maintenance (European PPP Expertise Centre, 2015).

CHAPTER THREE

3.0

RESEARCH METHODOLOGY

3.1 Research Design

A research design is the structure of techniques and methods or overall strategy that was consciously selected by the researcher to integrate different components of a research in a coherent and logical way in order to effectively solve the research problem (Bhat, 2019). According to Kirshenblatt-Gimblett (2006), It lays up the framework for data collection, measurement, and analysis. It is a general plan that assists the researcher in answering the research questions in a systematic way; it must capture the study objectives, research questions, resources for data collection, and constraints faced by the research (Nkrumah *et al.*, 2017). It is the overall plan used to connect theoretical problems of the research to the achievable empirical research (Brian, 2018); put in other words, it details what data needs to be collected, methods for collecting data, analysis techniques; all targeted toward solving the research problem.

3.1.1 Mixed methods research design

According to Shorten and Smith (2017), the mixed method is a research method in which researchers solicit, collect and examine data that are both quantitative and qualitative in nature in the same study. The idea is to take advantage of the strength of both qualitative and quantitative methods. This design method is suitable for answering research questions that cannot be solved alone by quantitative or qualitative methods (Ivankova, 2006; Andrew and Halcomb, 2012). The participants are provided with the opportunities to make their voice heard, for their experiences to be felt. This, can help in shaping the exploration processes and enrich evidences that gives a deeper response to the questions (Wisdom and Creswell, 2013).

Since, every research has a list of questions to be assessed; it is the function of a research design to provide insight into the methodology for answering these questions

(Bhat, 2019). For the purpose of this study, whose aim is to appraise the potentials of Public Private Partnership (PPP) in maintenance of public infrastructure such as public buildings, the research design that will be adopted is a mixed method research design.

According to Halcomb and Hickman (2015) and Shorten and Smith (2017), there are 4 types of mixed research method and they are;

- a) Explanatory sequential: in this type, collection and analysis of the quantitative data are done first, before the qualitative data. This is done in order to explain the quantitative data (that is, QUAN →QUAL)
- b) Exploratory sequential: in this type, collection and analysis of qualitative data are done first, before quantitative data. This is done to test the empirical findings (that is, QUAL →QUAN)
- c) Parallel: this is the type in which both qualitative and quantitative data are obtained and analysed simultaneously (that is, QUAL + QUAN)
- d) Nested type: this is the one in which either the qualitative design or quantitative design with the alternative paradigm embedded within the study to answer a complementary question (QUAL + quan or QUAN + qual).

This study leveraged the benefits of having qualitative and quantitative data to achieve its aim. There are research questionnaires that are better solved using a combination of quantitative and qualitative methodology, and the mixed methods research approach is suitable for this scenario (Andrew and Halcomb, 2012).

3.2 Data Collection

3.2.1 Unit of analysis

The first step in data analysis is to determine the unit of analysis (Trochim, 2020). The person or item from which the business researcher gets data is the unit of analysis. It responds to the questions of "what" and "who" are being investigated in a business study. It is the entire unit that is being investigated. It is defined as the major entity that a researcher is investigating in his or her study, and it is one of the most essential ideas in a research endeavor (Trochim, 2020). Individuals, groups of individuals, organizations, countries, technologies, and things that the investigation is looking into are all included. Existing projects and persons were used as the unit of analysis for this study. The people are construction professionals and other non-allied construction based professional, involved in PPP and maintenance works. The staff that work at the Infrastructure Concession Regulatory Commission (ICRC), or other parastatals and government agencies in charge of infrastructure maintenance as admin or research personnel. These non-allied construction professionals may not be involved in maintenance but are well informed about PPP. These non-allied construction professionals who are well informed about PPP were sampled using interviews. The construction professionals considered are those with the requisite experience in both maintenance and PPP. This is to ensure that valid information that would aid the attainment of the study aid is gathered. Observation was on planned visits to the site of the public infrastructure with the approval of the organisation.

3.2.2 Study population

The population is the total number of people, objects, or events that have observable characteristics (Mugenda and Mugenda, 2003). The participants in this study are construction experts from both governmental and private organizations in Abuja. Also,

the middle and top management staff who take part in the decision making in the organizations. These are policy makers in every organisation. These managers must possess requisite knowledge on the subject of PPP models development and applications. These professionals are registered Quantity surveyors, Architects, Builders, and Engineers plying the trades either in public or private organisation in Abuja, Nigeria. The premise for choosing Abuja is hinged on the fact that it is the administrative headquarters of Nigeria and there are a lot building development projects. Abuja houses the federal ministry of power, works and housing which is the monitoring ministry of the government. Saidu and Shakantu (2016) consider it a metropolitan city with a large number of construction-related specialists employed in construction or consulting firms in the built environment. The population of this study will be 10,306 people for the purpose of administering the questionnaire. The list of professions is shown in Table 3.1.

Table 3.1: Sample frame for qualitative

Item Nr.	Respondent	Population
A	Architects (NIA)	598
B	Builders (NIOB)	606
C	Engineers (NSE)	7900
D	Quantity Surveyors (NIQS)	1200
	Total	10,304

3.2.3 Sampling frame

The sampling frame is a list or register of individuals, groups, locations, or other entities that will be studied and from which samples/data will be taken (Cooper and Schindler,

2014). Middle and top managers of the public and private organisations were sampled using purposive sampling techniques especially for the interview session and observation.

The population of respondents for the segment requiring the use of a questionnaire was drawn from the registers of the Nigerian Institute for Quantity Surveyors (NIQS), Nigerian Institute of Building (NIOB), Nigerian Society of Engineers (NSE), and Nigerian Institute of Architects in Abuja (NIA).

3.2.4 Sample size

Because the sample size is related to the population, it is a subset of the population from whom data will be collected for analysis (Nkoli, 2011; Cooper and Schindler, 2014). The study's sample size was calculated using the methodology from Krejcie and Morgan (1970) at a 95% confidence level, and it is 370 people.

$$S = \frac{X^2 NP (1 - P)}{d^2 (N - 1) + X^2 P (1 - P)} \quad (3.1)$$

Where;

S = sample size from finite population

X = based on confidence level 1.96 for 95% confidence was used for this study

d = precision desired, expressed as a decimal (i.e. 0.5 for 5% used for this study)

P = estimated variance in population as a decimal (i.e. 0.5 for this study)

N = total number of population, 10,304

$$\begin{aligned}
s &= \frac{1.96^2 \times 10,304 \times 0.5 \times (1-0.5)}{(0.05^2 \times (10,304 - 1)) + (1.96^2 \times 0.5 \times (1-0.5))} \quad \square \\
&= \frac{9897.8824}{(25.7625 + 0.9604)} \\
&= \frac{9897.8824}{26.7229} \quad s = 370 \\
&\text{Therefore, } s = 370
\end{aligned}$$

A total of 154 questionnaires were retrieved from the 370 distributed during the trial, with two being eliminated due to incomplete responses. Only 152 people responded, representing a 41.08 percent effective response rate. This response rate was declared adequate and the data collected were used for the analysis. The reason the response rate of 41.08% was deemed adequate for analysis was premised on Adama *et al.* (2018) and Akinkunmi *et al.* (2018) submissions. It was submitted that a response rate that is greater than 20% is adequate in a study involving the use of questionnaires.

3.3 Sampling Technique

This study involves the collection of qualitative and quantitative data, and the use of instrument such as observation, interview, and questionnaire. This informs the use of purposive sampling techniques and random sampling techniques. The sampling techniques allow the selection of respondents who are a proportion of the population (Oladun, 2012). In order to administer the questionnaires and collect data, this study used a basic random sample procedure. This was done to ensure that all of the samples had an equal probability of being chosen. Well-structured questionnaires, interviews, and observation were employed to collect primary data for the study.

Interview

Interviews entail a conversation between a researcher (interviewer) and the respondents (interviewee) during which questions are asked and replies are given, as well as data being collected through careful listening and recording (Hesse-Biber and Leavy, 2011). The opinions, attitudes, and experiences of the respondents are sought. Interviews are useful for gathering personal information that can't be captured in a questionnaire. As a result, data is gathered from participants via spoken communication. There are three (3) types of interview highlighted by Hesse-Biber and Leavy (2011). These are: (1) Structured interviews, (2) Semi structured interviews, and (3) Open ended interviews. This study adopted the 'face-to-face' structured interview in the collection of data using the purposive sampling techniques. This technique was because the targeted respondents are expected to have experience with PPP models, experienced in maintenance work, and must be between middle and top management of their organisation. The purposive sampling techniques which is a non-probabilistic procedure is ideal for the interview sessions. Thus, since it practically difficult to determine the number of the non-allied construction professionals who are experienced and/or involved in PPP, the purposive sampling techniques was adjudged okay for use in the interview. In the end, 25 participants (15 construction professionals and 10 non-construction professionals) took part in the interview session. Interview responses were recorded and later transcribed for easy of data analysis. Each interview session took an average of 25 minutes per interviewee, and it covered over a period of one month.

Observation

The observation involves locational visit of public infrastructure for data on the maintenance status to be obtained. This is also another way of getting first hand data on the status of public buildings. Data collected through observation were based on what were seen and this was backed-up by the interview sections. The public buildings observed were;

- i. General hospital Gwarimpa, Abuja
- ii. Police barracks Gwagwalada, Abuja
- iii. Federal Science and Technical College, Orozo, Abuja.
- iv. National Hospital, CBD, Abuja.
- v. Federal Treasury Academy, Orozo, Abuja.
- vi. Gwagwalada Area Council Secretariat

3.4 Data Collection Instrument

Since this study adopted a mixed research method which involves qualitative and quantitative data, the instrument for data collection were questionnaire, structured interview and observation. Questionnaire survey is a systematic method of obtaining data based on a sample (Tan, 2011). Questionnaire was used to collect data on; the current state of public infrastructure (objective 1), the current model for infrastructure maintenance in Nigeria (objective 2), limitations to the current model for maintenance of public infrastructure (objective 3), the effect of Public Private Partnership (PPP) maintenance model on infrastructure in Nigeria (objective 4), The questionnaire used a 5-point Likert scale, with 5 being the highest possible score. Manu (2015) claims that

the Likert scale lowers uncertainty and is simple to use. Interview was conducted as a back-up to the questionnaires and to solicit for information not captured by the questionnaire. Also, observation of the public infrastructure was made to get current state of the infrastructures sampled.

3.5 Method of Data Analysis

Descriptive statistics such as tables, charts, percentile, mean item score, relative importance index, and regression analysis were used to analyze the collected data. The general information of the respondents were assessed using percentages and frequencies. Tables and charts were used to present the result of the analysis. Mean item score and percentages were used to analyse and rank variables in objectives 1 and 2. Objective one (1) is to determine the current state of public infrastructure, and objective two (2) is to assess the current model of PPP for maintenance for infrastructure in Nigeria.

The formula for mean item score is written as

$$\text{Mean Item Score (MIS)} = \frac{5n_4 + 4n_4 + 3n_4 + 2n_2 + 1n_1}{n_5 + n_4 + n_3 + n_2 + n_1} \quad (3.2)$$

Data collected on objective 3 and 4 were analysed using relative importance index (RII). Objective 3 is to investigate the limitations of the current model for maintenance of public infrastructure in Nigeria., while objective 4 is to Investigate the effect of Public Private Partnership (PPP) maintenance model on infrastructure in Nigeria.

The relative importance index (RII) can be calculated using the formula suggested by (Fagbenle *et al.*, 2004).

$$\text{Relative Important Index (RII)} = \frac{\sum P_i U_i}{A \times N} \quad (3.3)$$

Where;

P_i = respondent rating of variables

U_i = Number of respondents placing identical weighting/rating on variables

A = highest weighting (i.e. 5 used in this study)

N = Sample size

Furthermore, in order to determine if there is a relationship between the limitation of PPP (objective 3) and the effects of PPP (Objective 4), a regression analysis was carried out.

The fifth objective which is to appraise the potentials of PPP in maintenance of Public infrastructure (building) was analysed based on critical examination of the results interviews, and from previous sections of the study and literature review.

The qualitative data gathered through interviews were analysed using content analysis. Literature review is usually the first exercise towards carrying out any research. The review of literature gives an insight into existing studies (theories and concepts) that are related to the study being undertaken (Fellow & Liu, 2015). This study will adopt an extensive literature review for the purpose of identifying, evaluating, integrating, bridging and interpreting existing body of knowledge available and related to the subject under consideration. This is in line with Creswell (2014) who sees literature review as the systematic method which permits the identification, evaluation, integration, bridging and interpretation of the existing body of knowledge.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 General Information of Respondents

Table 4.1 is the result of the analysis of the general information of the respondents. The analysis shows that most of the respondents sampled are from private organisations (57.89%), followed by public organisations (42.11%). In terms of professions/responsibility, the result shows that professional builders are more with (35.53%), followed by engineers (29.61%), then Quantity Surveyors (20.39%), and lastly, Architects (14.47%).

A look at the year of work experience of the respondents shows that only 15.13% of them have their year of working experience to fall within 1-5 years range, while 33.5% and 29.61% falls between the range of 5 to 10 and 11 to 15 years respectively. Also 13.82% and 7.89% of the population falls between the ranges of 16 to 20 years and 21 years and above respectively. However, the average years of working experience of the respondents is calculated as approximately 10.14 years. This implies that they are experienced enough and responses from them can be relied upon.

In terms of academic qualification, the highest is BSc/Mtech (34.21%), followed by MSc./Mtech (27.63%), then HND (20.39%), then PGD (15.13%), and PhD are 2.63% . Going by their professional membership, 29.61% are MNIQB, 27.63% are MNSE, followed by MNIQS (18.42%), MNIA (13.82%) and lastly, students/probationers are 10.53%. Furthermore, in terms of whether they have been involved in maintenance projects before, 98.68% of the respondent indicated 'yes'. The question of whether they currently use PPP for maintenance work, 96.71% indicated 'No'.

However, the result in this section shows that the respondents have the requisite experience and are educated enough to take active part and give dependable information that will help achieve the aim of this study.

Table 4. 1: General Information of Respondents

Category	Classification	Freq.	%	Cumm. %
Organizational category	Public organisations	64	42.11%	42.11%
	Private organisations	88	57.89%	100.00%
	TOTAL	152	100.00%	
Profession/responsibility	Builders	54	35.53%	35.53%
	Quantity Surveyor	31	20.39%	55.92%
	Engineers	45	29.61%	85.53%
	Architects	22	14.47%	100.00%
	TOTAL	152	100.00%	
Years of experience	1 - 5 years	23	15.13%	15.13%
	5-10 years	51	33.55%	48.68%
	11-15 years	45	29.61%	78.29%
	16 - 20 years	21	13.82%	92.11%
	21 years and above	12	7.89%	100.00%
	TOTAL	152	100.00%	
Academic Qualification	OND	0	0.00%	0.00%
	HND	31	20.39%	20.39%
	PGD	23	15.13%	35.53%
	BSc./Btech	52	34.21%	69.74%
	MSc./Mtech	42	27.63%	97.37%
	PhD	4	2.63%	100.00%
	TOTAL	152	100.00%	
Profession membership	None	16	10.53%	10.53%

				3%
	MNIA	21	13.82%	24.34%
	MNIOB	45	29.61%	53.95%
	MNSE	42	27.63%	81.58%
	MNIQS	28	18.42%	100.00%
	TOTAL	152	100.00%	
Involved in any maintenance project before?	Yes	150	98.68%	98.68%
	No	2	1.32%	100.00%
	TOTAL	152	100.00%	
Do you currently use PPP in carrying out maintenance work?.	Yes	5	3.29%	3.29%
	No	147	96.71%	100.00%
	TOTAL	152	100.00%	

In determining the level of agreement on role of PPP models as appropriate vehicles for maintenance of public infrastructure especially with the terrible state of public buildings and infrastructure status, shown on Table 4.2. They accepted the fact that with the terrible state of public buildings and infrastructures, the use of PPP models is an appropriate vehicle for their maintenance. The combine agreement level is 83.55%.

Table 4.2 PPP Models are Appropriate Vehicles for Maintenance of Public Infrastructure

Variables	Frequency	Percent	Cumm. Percent
Strongly Agree	68	44.74%	44.74%
Agree	59	38.82%	83.55%
Neutral	13	8.55%	92.11%
Disagree	10	6.58%	98.68%
Strongly Disagree	2	1.32%	100.00%

Similarly, it was strongly agreed that PPP models are appropriate vehicles for addressing institutional challenges required to ensure continued maintenance of public buildings and infrastructures nationwide, shown on table 4.3. The survey participants agreed that PPP models are appropriate for addressing institutional challenges required to ensure continued maintenance of public buildings and infrastructures nationwide. The combine agreement level is 82.24%.

Table 4.3. PPP Models are Appropriate Vehicles for Addressing Institutional Challenges

variables	Frequency	Percent	Cumm. Percent
Strongly Agree	65	42.76%	42.76%
Agree	60	39.47%	82.24%
Neutral	14	9.21%	91.45%
Disagree	11	7.24%	98.68%
Strongly Disagree	2	1.32%	100.00%

Table 4.2 and 4.3 show that PPP have to be considered by the public (government) for changing the narrative regarding public infrastructure maintenance in the country. The study revealed that PPP is accepted as the most appropriate model for maintenance of public infrastructure. Also, it was agreed that PPP models are appropriate for addressing institutional challenges required to ensure continued maintenance of public buildings and infrastructures nationwide

4.2 Interview Respondents General Details

Table 4.4 contains the results derived from the 25 interviewees' responses. The result revealed that that 60.00% work with the public organization, and 40.0% work with private organizations. In terms of professional representations, 12.0% are architects,

16.0% are builders, 20.0% are engineers, 12.0% are quantity surveyors, and the remaining 40.0% are made non-allied construction people (professionals). In addition, 8.0% had PGD and PhD each 48.0% had a BSc/B.Tech, and 36.0% had a Master degree. In terms of professional membership, 12.0% are MNIA, 16.0% are MNIOB, 20.0% are MNSE, 12.0% are MNIQS, and the remaining 40.0% are made of other non-construction base professionals Finally, in terms of year of experience, the range of their experiences shows that 0.0% had 1-5years and above years each, 16.0% had 5-10years, 28.0% had 11-15years, 32.0% of them had 16-20years, and 24.0% had 20years and above. Also, the average year of work experience of the respondents is 13years.

This results in addition to that on Table 4.1 shows that the respondents experienced enough and have the requisite knowledge to take active part and give dependable information on the subject under study (that is, maintenance and PPP).

Table 4.4: Interview Respondents General Information

Category	Classification	Freq.	%
Organizational Type	Public organisation	15	60.00%
	Private organisation	10	40.00%
	TOTAL	25	100.00%
Profession of respondents	Architect	3	12.00%
	Builder	4	16.00%
	Engineer	5	20.00%
	Quantity surveyor	3	12.00%
	Others (non-construction professionals)	10	40.00%
	TOTAL	25	100.00%
	Years of experience	1 - 5 years	0
5 - 10 years		4	16.00%
11 - 15 years		7	28.00%
16 - 20 years		8	32.00%
Above 20		6	24.00%
TOTAL		25	100.00%
Academic Qualification		HND	0
	PGD	2	8.00%
	Bsc/Btech	12	48.00%
	Master degree	9	36.00%
	Doctorate degree	2	8.00%
	TOTAL	25	100.00%
Professional membership	MNIA	3	12.00%
	MNIOB	4	16.00%
	MNSE	5	20.00%
	MNIQS	3	12.00%
	Others (non-construction professionals)	10	40.00%
	TOTAL	25	100.00%

4.3 Meaning of Building Maintenance and PPP

The interviewee's understanding of what building maintenance and what PPP mean is captured below;

The summary of the interviewees understanding of building maintenance is centred on; preserving the economic value of an asset, protecting the original quality of a facility, ensuring safety and health of occupants, prevention of deterioration of building, prevention of sudden decay and collapse of buildings. They see public private partnership, PPP as an agreement usually of long term between the public sector and the private sector for the delivery of goods or services; it involved appropriate sharing of risks, expertise, and rewards. Also, it's an arrangement between public authorities and the private sector to finance, construct, renovate or maintain a facility or for other responsibilities.

4.4 State of Public Building Infrastructure

Table 4.5 shows the result of the analysis of the data collected on the various components of building requiring maintenance and in bad shape. The result reveals that the part of the building requiring maintenance is wall (MIS=4.48), followed by painted surfaces (MIS=4.46), then toilet facilities (MIS=4.26), electrical service (MIS=4.00), and Floor (MIS=3.96). The least part of the building requiring maintenance is the foundation with MIS score of 3.12.

Table 4.5 Condition of Building Parts

S/No	Building components	MIS	S.D	Rank
1	Foundation	3.12	1.695	10 th
2	Roof	3.52	1.159	8 th
3	Floor	3.96	1.136	5 th
4	Wall	4.48	1.000	1 st
5	Painting	4.46	0.797	2 nd
6	Windows	3.80	1.333	7 th
7	Doors	3.49	1.307	9 th
8	Electrical services	4.00	0.765	4 th
9	Toilet facilities	4.26	1.021	3 rd
10	Sewage system	3.93	1.265	6 th

It was revealed that the components of building requiring frequent maintenance are walls, painting surfaces, toilet facilities, electrical services and floor. This result was supported by the interview and observation reports which shows that the ‘best description for the current state of public building infrastructure in your area’ is poor and in bad state. The interview report shows that; the bad states are caused by; poor maintenance culture, poor budgetary provision for maintenance, corruption, negligence, and over crowding of offices and government housings. One of the interviewees said that ‘funds made for maintenance’ as seen as free monies and some top official some time do little maintenance and exaggerate the figures in order to embezzle money’. An interviewee also said the processes/bureaucracy involved in securing fund from the budget is a critical causes of the poor state observed.

This finding supports the reports of (Ugwu *et al.*, 2018; Odediran *et al.*, 2012; Ajanlekoko, 2001; Oyedele, 2006). Ugwu *et al.* (2018) reported that, in Nigeria, it has

been found that 80% of the public buildings requires one or more maintenance work. It was also confirmed that public buildings are in very terrible conditions, needing both structural and decorative repairs attention (Odediran *et al.*, 2012); Ugwu *et al.*, 2018). Nigeria's infrastructure report, like that of any other third-world country, is nothing to write home about (Oyedele, 2012). Both numerically and qualitatively, public housing is in a bad situation (Ajanlekoko, 2001; Oyedele, 2006). Oyedele (2012) also asserted that the bulk of facilities have degraded and require repair, rehabilitation, refurbishment, or replacement.

Even though, the national building maintenance policy provides for maintenance to be carried out at certain intervals, by considering the life cycle of the elements/items, the ministry or department involved normally take a longer time to do that.



Plate 4.1: An example of a structural crack in a wall

Source: Author's Field observation, 2020



Plate 4.2: An example of a damaged toilet facilities

Source: Author's Field observation, 2020



Plate 4.3: An example of a damaged electrical facilities

Source: Author's Field observation, 2020



Plate 4.4: An example of a damaged floor

Source: Author's Field observation, 2020

4.5 The Current Model for Infrastructure Maintenance in Nigeria

4.5.1. Infrastructure maintenance method

Table 4.6 shows the result of the analysis of the data gathered on Infrastructure maintenance method. The result shows that the current practices in terms of maintenance of public infrastructures in Nigeria is labour only method (MIS=4.76), then direct labour methods (MIS=4.38).

Table 4.6: Infrastructure Maintenance Method

S/No	Infrastructure maintenance method	MIS	S.D	Rank
1	Contracting method	3.28	0.839	3 rd
2	Direct labour methods	4.38	0.934	2 nd
3	Labour only method	4.76	0.427	1 st

4.5.2. Forms of maintenance work used in public maintenance projects.

Table 4.7 shows the result of the analysis of the data gathered on form of maintenance work are used in the public maintenance project. The result shows that the top form of maintenance work are used in the public maintenance project are; servicing (MIS=4.91), followed by renovation (MIS=4.65), then rectification (MIS=4.58).

Table 4.7: Forms of Maintenance Work Used in Public Maintenance Projects.

S/No	Form of maintenance	MIS	S.D	Rank
1	Servicing	4.91	0.352	1 st
2	Rectification	4.58	0.495	3 rd
3	Replacement	4.39	1.017	4 th
4	Renovation	4.65	0.478	2 nd
5	Conversion	4.15	0.940	6 th
6	Extension	3.65	0.478	7 th
7	Alteration	4.38	0.745	5 th

4.5.2. Type of maintenance used on public projects

Table 4.8 shows the result of the analysis of the data gathered on the types of maintenance according to how frequency of use in public projects. The result shows that corrective maintenance is the most used type of maintenance used in public building.

Table 4.8: Type of Maintenance Used on Public Projects

S/No	Type of maintenance	MIS	S.D	Rank
1	Planned maintenance	3.95	1.354	3 rd

2	Preventive maintenance	4.12	0.597	2 nd
3	Corrective maintenance	4.63	0.717	1 st

Results displayed on Table 4.6 to 4.8, revealed that current practices in terms of maintenance method of public infrastructures are labour only method and direct labour methods. Also, public building maintenance works mostly take the form of servicing, renovation and rectification. The common type of maintenance is corrective maintenance. This finding is in line with Odediran, 2012; Olatunji *et al.*, 2016). Odediran (2012) specified that a larger chunk of building occupants undertake maintenance work in the form of ‘servicing’ on daily, weekly, monthly, quarterly, and yearly basis. This is done in the form of cleaning, washing of windows, regular painting and decoration. Furthermore, Olatunji *et al.* (2016) reported that the current model of carrying out maintenance in Nigerian public buildings are through contracting methods and direct labour methods which are both traditional in nature. It was further stated that regardless of the methods used, the form of maintenance is usually through servicing, rectification, replacement and renovation.

The various building/facility maintenance units/works department have peculiar outlines of the procedure for the preparation of a planned preventive maintenance exercise. These include taking stock and inventory of each facility to be maintained; consideration of the history of the building which include construction date, plans and sections, nature of sub base, etc. Floor areas to be covered, Services within the building and furniture used in the building. The findings from the interviews shows that the maintenance/facility management/works department are responsible for the maintenance of the facilities/infrastructures. The maintenance outlines/procedures allows for the use of direct labour and labour only type of contract and supervised by

the concerned department. Thus, direct labour methods and the use of labour only contracting is what organizations used for carrying out maintenance work. It was found from the interview that renovation, replacement, servicing, and rectification are the common form in which maintenance jobs take in public buildings. Although, a good number of them says that poor materials used and workmanship deployed during construction were to be blamed. Corrective work is what ‘we normally do in my organization’; this was stated by one of the respondents. The ‘maintenance policy provides for planned maintenance targeted towards preventions over corrections but the system is such that we wait till the part is bad before maintaining it’ this was said by another interviewee. The result revealed that corrective work is prominent, followed by little preventive work.

4.6 The Limitations of the Current Model for Maintenance of Public Infrastructure

Table 4.9 shows the result of the analysis of the data collected on the Limitations of the Current Model for Maintenance of Public Infrastructure. The result shows that; high life cycle cost (RII=0.986), poor quality of maintenance work (RII=0.888), weak/little competition in public services (RII=0.888), Inefficient risks allocation (RII=0.868), and Delay in Infrastructure Provision, maintenance and Additional Revenue (RII=0.844).

The least limitation of the current model of maintenance are; Weak work flow for occupants (RII=0.688), the current model may not guarantee prevention of building collapse (RII=0.56), It does not ensure continuous availability of the theatre (RII=0.53), maintenance contract under the current model does not prevent sudden breakdown of

building component and equipment (RII=0.508), and maintenance contract under the current model does not Improved quality management (RII=0.454).

Table 4.9: Limitations of Current Model of Public Building Maintenance

S/N	Limitations of Current Model of Public Building Maintenance	RII	Rank
1	high life cycle cost	0.986	1 st
2	inefficient risks allocation	0.868	4 th
3	Lack of speed implementation of maintenance work	0.816	9 th
4	poor quality of maintenance work	0.888	2 nd
5	Sometime payment are not linked to performance	0.808	10 th
6	little or no incentive to perform	0.802	11 th
7	poor public sector efficiency	0.742	14 th
8	weak/little competition in public services	0.888	2 nd
9	Delay in Infrastructure Provision, maintenance and additional revenue	0.844	5 th
10	Weak work flow for occupants	0.688	16 th
11	maintenance work does not improve the attraction and aesthetics of the building	0.708	15 th
12	current model does not ensures the facility meets functional requirements and quality standards	0.752	13 th
13	the current maintenance contracts does not make building conducive for occupants	0.826	7 th
14	the current model does not improved coordination and efficiency of scheduled maintenance	0.832	6 th
15	maintenance contract under the current model does not help to reduced repair/operational cost	0.822	8 th
16	maintenance contract under the current model does not Improved quality management	0.454	20 th
17	the current model may not guarantee prevention of building collapse	0.560	17 th
18	maintenance contract under the current model does not prevent sudden breakdown of building component and equipment	0.508	19 th
19	it does not ensure continuous availability of the theatre	0.530	18 th
20	Building quality changes over time	0.762	12 th

The study found that limitation of the current model of direct labour or labour only contract for maintenance of buildings are; high life cycle cost, poor quality of maintenance work, weak/little competition in public services, Inefficient risks allocation, and Delay in Infrastructure Provision, maintenance and Additional Revenue. This finding is supported by reports of (Oyefeko, 1999; Adenuga, *et al.*, 2010b). Building shells are key physical features that include structural frames, floors, the building outer envelope, and the vertical transportation/services core, according to reports. These have a 40- to 50-year lifespan. Ceilings, partitions, and floor finishes, for example, have a lifespan of only 5 years on average. The life duration of building services, which comprise mechanical and electrical services, telecommunication and data, lighting, and interior transportation systems, is 5 to 25 years.

These elements or items are subjected to constraint use and the pressure or frequency of use could affect the interval of maintenance on them. The poor maintenance attitude and culture of most top management is also an issue. This was pointed out by Ugwu *et al.*, (2018), who stated that lack of a maintenance policy, insufficient funding for maintenance, poor execution of maintenance work by designated accountable units/agencies, corruption, a lack of skilled employees (human capacity building), occupant misuse of facilities, and bad architectural drawings/designs are among the issues that are stated to be obstacles to maintenance. The current methods of procurement of maintenance works have a lot of limitations, which has triggered the call for the use of modern techniques like PPP. According to Adegoke (2010), the limitations of this system of procuring maintenance work are, lack of skilled labour, more expensive and lastly, hard to recall people should there be emergency.

The poor states of public infrastructure are caused by a number of factors which could be attributed to the current model of public building maintenance. Interviewees (Ref no. 1, 3,4, 6, 8 & 11) have similar opinion regarding the causes of the poor state of public infrastructure. They said that

“Government employees have poor attitudes when it comes to the care and maintenance of public facilities, over population and too much pressure on public infrastructure, lack of uniform and dedicated maintenance contracts across public infrastructure”.

For (Ref no. 12, 14, 16, 18, 21, 24) comments have similar themes *“public organisations have poor maintenance culture, and the government neglects public asset maintenance”*. In addition,

Ref no. 10, 2, 5, 15, 17, 23,25) talked about the

“Heads of departments normally claim that budgetary provisions for maintenance of public facilities are inadequate, furthermore, there are evidences of misuse/mismanagement of funds provided for maintenance work”

Furthermore, the respondents were of the opinion that PPP can be used to assist government in maintaining public infrastructures like offices, housing’, as 100% of them said yes when asked if PPP can be used to assist government in maintaining public infrastructure.

On this question; there is a popular saying that Nigerians have poor maintenance culture. How true is this saying? 60% of those interviewed said that it is true especially with public facilities provided and management by government, and 40% it is true, especially with the attitudes of most people towards maintenance of buildings not owned by them. Even though these facilities are provided using tax payers monies it is important for all hands to be on deck in order to maintain and put them in order for continues repeating of their economic values and benefits.

4.7 Effect of Public Private Partnership (PPP) Maintenance Model on Infrastructure

Table 4.10 shows the result of the analysis of the data collected on the effects of PPP maintenance model on infrastructure. It can be seen that the leading top ten (10) effects according to the respondents are; PPP Improves/ better Service Quality of maintenance work (RII=0.952), PPP maintenance contract will help to Prevent sudden breakdown of building component and equipment (RII=0.936), PPP ensures More Efficient Allocation Of Risk (RII=0.93), the use of PPP model will help to Prevent building collapse (RII=0.93), With PPP, maintenance work are implemented Faster (RII=0.928), With PPP model, there will be More Competition In Public Service (RII=0.928), Using PPP model for maintenance work will help to Maintain attraction and aesthetics of the building (RII=0.928), The use PPP maintenance model can help reduced Life-Cycle Costs (RII=0.922), There is Incentive/Motivation To Deliver in PPP model (RII=0.874), and PPP ensures Acceleration Of Infrastructure Provision, maintenance and Additional Revenue (RII=0.830).

The least effects of PPP maintenance model on infrastructure are; PPP helps to Improved work flow for occupants (RII= 0.726), PPP maintenance model Ensures the facility meets functional requirements and quality standards (RII= 0.724), PPP maintenance contract will Improved quality (quality management) (RII=0.694), PPP will Ensure continuous availability of the theatre (RII=0.684), PPP ensures that Payment are Linked To Performance (RII=0.63).

Table 4.10: Effect of Public Private Partnership (PPP) Maintenance Model on Infrastructure

S/No	Effect of PPP maintenance model on infrastructure	RII	Rank
1	The use PPP maintenance model can help reduced Life-Cycle Costs	0.922	8 th
2	PPP ensures More Efficient Allocation Of Risk	0.930	3 rd
3	With PPP, maintenance work are implemented Faster	0.928	5 th
4	PPP Improves/ better Service Quality of maintenance work	0.952	1 st
5	PPP ensures that Payment are Linked To Performance	0.630	20 th
6	There is Incentive/Motivation To Deliver in PPP model	0.874	9 th
7	PPP ensures that there is Better Public Sector Efficiency	0.734	15 th
8	With PPP model, there will be More Competition In Public Service	0.928	5 th
9	PPP ensures Acceleration Of Infrastructure Provision, maintenance and Additional Revenue	0.830	10 th
10	PPP helps to Improved work flow for occupants	0.726	16 th
11	Using PPP model for maintenance work will help to Maintain attraction and aesthetics of the building	0.928	5 th
12	PPP maintenance model Ensures the facility meets functional requirements and quality standards	0.724	17 th
13	PPP maintenance contracts Makes building conducive for occupants	0.826	11 th
14	PPP contracts helps to Improved coordination and efficiency of scheduled maintenance	0.802	12 th

15	PPP maintenance contract would help	Reduced repair/operational cost	0.760	13th
16	PPP maintenance contract will	Improved quality (quality management)	0.694	18 th
17	the use of PPP model will help to	Prevent building collapse	0.930	3 rd
18	PPP maintenance contract will help to	Prevent sudden breakdown of building component and equipment	0.936	2 nd
19	PPP will	Ensure continuous availability of the theatre	0.684	19 th
20	PPP maintenance model will help to	Guarantee building quality overtime	0.746	14 th

It was further found that the effects of PPP maintenance model on infrastructure are; PPP Improves/ better Service Quality of maintenance work, PPP maintenance contract will help to Prevent sudden breakdown of building component and equipment, PPP ensures More Efficient Allocation Of Risk, the use of PPP model will help to Prevent building collapse, With PPP, maintenance work are implemented Faster, With PPP model, there will be More Competition In Public Service, Using PPP model for maintenance work will help to Maintain attraction and aesthetics of the building, The use PPP maintenance model can help reduced Life-Cycle Costs, There is Incentive/Motivation To Deliver in PPP model, and PPP ensures Acceleration Of Infrastructure Provision, maintenance and Additional Revenue.

In order to reinforce the findings on the Table above, the interviewees were asked to state ‘What role do you think PPP maintenance contract can play on the public facilities/infrastructures’. The key findings from the interview are; According to Interviewees with (ref no. 2,6,10,14,17,18,24), The role of PPP maintenance contract with the highest frequency in terms of content similarity.

“It will help to preserve the physical features of the building, thus, reducing needs to regular maintenance”.

“The financial and other economic returns from using the building/infrastructure will improve,” “ and the quality of building can improve and meet modern day needs.” it will ensure that the facilities are useful at all times and then meeting their functional requirements”.

As part of the strategies for ensuring that building remains maintained, the respondents were asked to state other means of maintenance of public infrastructures aside the use of PPP. Various themes common with the respondents connotes that there is a positive attitude of occupant towards emphasis on prevention over correction. These themes are’

“reducing the number of occupant/ pressure on few facilities provided, having positive mental attitude about maintenance, Occupants should be careful with how the use and see the infrastructure they occupy, positive attitude of top management on maintenance, positive attitude of top management managing maintenance funds, provision of high quality materials and use of qualified labours during construction, use of adequate and high quality materials, having a good plan on ground for maintenance work, emphasis on prevention over corrections, and planning and preventing failures of buildings”.

In order to ascertain the level of implementation of the existing policy on building maintenance, the interviewees were asked ‘how best you describe the level of implementation of the existing national building maintenance policy’, the result obtained shows that there is an issue with the current national building maintenance

policy, thus it is poorly implemented. A good portion of the interviewees (ref no. 1to 6, 12-16, 18-24) said that,

“The existing national building maintenance policy is neglected and thus, is not well implemented; it is poorly and not properly implemented”

4.8 Simple Linear Regression Limitations of Current Maintenance Model vs Effects of PPP Model

From the first regression model summary Table 4.11, the relationship between the effects of PPP maintenance model (independent variable) and the limitations of current models (dependent variable) was observed to be positive, weak and statistically significant. With R value of 45.8% and R^2 (coefficient of determination) value of 21%, this implies a weak relationship. This further means that the 21% changes in the success achieved in the maintenance using PPP model is a result of overcoming the limitations of the current model, while the remaining 79% was due to other factors (latent and extraneous variables) not considered in this study. The positive weak correlation indicates that there are limitations in the current model which affects maintenance and that the use of PPP in maintenance would improve the quality of public building maintenance. This further shows that PPP is required in maintenance of public infrastructures.

Table 4.11 Model Summary for Regression of the Assessed Constructs

Model	R	R Square	Adjusted Square	R Std. Error of the Estimate
1	0.458 ^a	0.210	0.202	0.37773

Furthermore, the Analysis of Variance (ANOVA) Table 4.12 indicates that the F value is 25.989, and P value of 0.000 which is less than 0.05 which was the level of significance set for analysis. This led to the conclusion that there is a weak relationship between PPP model for the maintenance of public infrastructure and the limitations of the current model.

Table 4.12 ANOVA of limitations of current maintenance model vs effects of PPP model

	Model	Sum Of Squares	df	Mean Square	F	Sig.
1	Regression	3.708	1	3.708	25.989	000 ^a
	Residual	13.983	151	.093		
	Total	17.691	152			

Table 4.13: Coefficients of the Regression Model of the Assessed Constructs

Model	Unstandardized		Standardized		Sig
	Coefficients		Coefficients		
	B	Std. Error	Beta	t	
1 (Constant)	1.65	.417		3.973	.00
Effects of PPP Maintenance model	.513	.101	.458	5.098	.00

4.9 Proposed Strategies for Adopting PPP in Maintenance of Public Infrastructure

Fig. 4.1 shows the framework for PPP in maintenance of Public infrastructure. The strategies shows that by preventing the causes of poor building maintenance conditions, and overcoming the limitations of the current system of labour only, direct labour method of maintaining public buildings, and development of appropriate maintenance plans and policies that will emphasise prevention over correction, and adopting PPP model for maintenance of public infrastructures, the right building condition would be met. PPP is the most appropriate model for maintenance of public infrastructure, and it is suitable for addressing institutional challenges required to ensure continued maintenance of public buildings and infrastructures nationwide. The use of PPP would

improve and provide better service quality of maintenance work and sudden breakdown of components and equipment will be prevented.

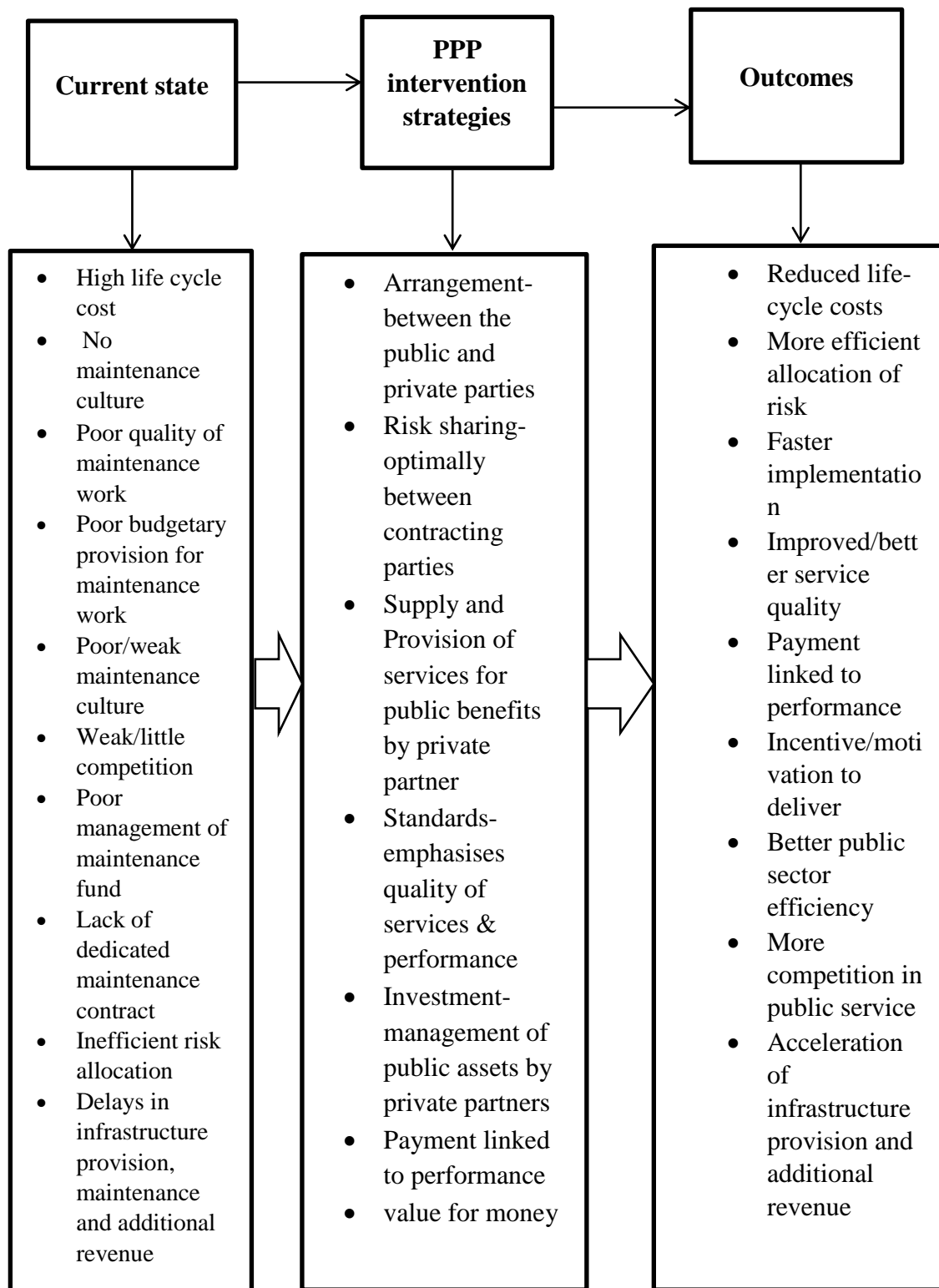


Figure 4.1: Proposed Strategy for Adopting PPP in Public Infrastructure Maintenance

The PPP model ensures that a quality infrastructure is built using the most suitable and standard materials and labour. It helps to improve the quality of work and condition of buildings, which would reduce the amount of maintenance work carried out. That is, it eliminates frequent maintenance of facilities, which make the infrastructure stand the test of time. The overall effect is reduction of the life cycle cost. One of the driving forces behind the use of PPP is the better services quality and faster implementation of maintenance exercise. PPP helps to overcome the weak/little completion in the existing maintenance model in that it brings in and ensure a more competitive public sector. PPP triggers the acceleration of infrastructure provisions, maintenance and added revenue. The public sector would have more money to channel to other revenue generation ventures in the economy. PPP ensures an efficient risk allocation among the parties. The inefficiency in risk allocation that is associated with the existing maintenance model is overcome, because of appropriate risk management of the PPP. Risk identification, assessment, analysis and allocation ensure that risks are allocated to the superior insurer. There is a dedicated maintenance contract, and proper fund management and administration with PPP. These ensure that delays in infrastructure delivery are avoided.

The result of the interview on the question: Do you think developing a framework using PPP in maintenance of Public infrastructure can bring some changes and improvement? The respondents said 'Yes', and According to interviewee no. '1'

“a framework using PPP in maintenance of Public infrastructure can bring some changes and improvement, but it requires proper supervision during implementation”.

Interviewee no'2' agreed that *“a framework using PPP in maintenance of Public infrastructure can bring some changes and improvement, but advocated for strict monitoring for it to be successful”.* It's obvious from these interviewees, it can be suggested that such a framework be backed-up with strict supervision and monitoring to ensure sustainable implementation. It was further suggested that the national building maintenance policy could incorporate the use of modern procurement methods like PPP for carrying out maintenance works especially properties provided, own and operated by government (public sectors).

A framework that will incorporate the benefits of PPP, especially in the areas of risk sharing, rewards, and other benefits as contained in the definition of PPP given by the interviewees *“An agreement usually of long term between the public sector and the private sector for the delivery of goods or services; it involved appropriate sharing of risks, expertise, and rewards. Also, it's an arrangement between public authorities and the private sector to finance, construct, renovate or maintain a facility or for other responsibilities”.*

For the developed framework to be sustainable, the PPP agreement must be for a very long term, so that parties would have enough time to recover their expenses and investment while not compromising quality.

4.10 Summaries of Findings

A summary of the key findings is shown in Table 4.14

Table 4.14 Summary of Key Findings

S/N	Objective	Findings
1	Current state of public infrastructure in Nigeria	Building walls, painted surfaces, toilet facilities, electrical services and floor are the components of building requiring frequent maintenance. It was found that public building is in bad state, and this condition was attributed to poor maintenance culture, poor budgetary provision for maintenance, corruption, negligence, and over crowding of offices and government housings
2	Current model for infrastructure maintenance in Nigeria.	The current models for infrastructure maintenance are ‘labour only method’ and ‘direct labour methods’. The maintenance works takes the form of servicing, renovation and rectification. Thus, maintenance is corrective in nature.
3	Limitations of the current model for maintenance of public infrastructure in Nigeria	Factor analysis revealed that the major limitations of the current model of maintenance that have to be overcome are; unsustainable structural stability, delayed implementation and poor efficiency of maintenance work, poor aesthetic and risks issues, unsustainable work flow and quality, and functional requirement issues and higher operating cost.
4	Effect of Public Private Partnership (PPP)	The major effects of PPP maintenance model on infrastructure are; PPP Improves/ better Service Quality of maintenance work, PPP maintenance contract will help to Prevent sudden breakdown of

maintenance model on infrastructure in Nigeria

building component and equipment, PPP ensures More Efficient Allocation of Risk, the use of PPP model will help to Prevent building collapse. The effectiveness of the use of PPP lies in its ability to; ensure Sustainable infrastructure provision and performance, better quality and lower operating cost, healthy competition and delivery of maintenance work, ensures continuous maintenance of structure, and Sustainable building structure; as revealed by factor analysis

5 Proposed strategies for adopting PPP in maintenance of Public infrastructure

The interventions show that by preventing the causes of poor building maintenance conditions, and overcoming the limitations of the current system of labour only, direct labour method of maintaining public buildings, and development of appropriate maintenance plans and policies that will emphasize prevention over correction, and adopting PPP model for maintenance of public infrastructures, the right building condition would be met.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

This study set out with the aim to propose strategies for Public Private Partnership (PPP) as a tool in maintenance of public infrastructure. The study utilized a survey design approach and simple random sampling technique in the collection of data. The study was able to appraise the potentials for adopting PPP model for maintenance of public Infrastructure by utilising data collected from construction professional in both public and private organisations.

Also, the study was able to: determine the current state of public infrastructure in Nigeria, assess the current model for infrastructure maintenance in Nigeria, investigate the limitations of the current model for maintenance of public infrastructure in Nigeria, and the effect of Public Private Partnership (PPP) maintenance model on infrastructure in Nigeria were found.

Based on the findings, building walls, painted surfaces, toilet facilities, electrical services and floor are the components of building requiring frequent maintenance. It was found that public building is in bad state, and this condition was attributed to poor

maintenance culture, poor budgetary provision for maintenance, corruption, negligence, and overcrowding of offices and government housing.

The current models for infrastructure maintenance are ‘labour only method’ and ‘direct labour methods’. The maintenance works takes the form of servicing, renovation and rectification. Thus, maintenance is corrective in nature. High life cycle cost, poor quality of maintenance work, weak/little competition in public services, Inefficient risks allocation, and delay in Infrastructure Provision, maintenance and additional revenue; are the limitations of the current maintenance system used.

It was also found that PPP Improves/ betters Service Quality of maintenance work, PPP maintenance contract will help to Prevent sudden breakdown of building component and equipment, PPP ensures More Efficient Allocation of Risk, the use of PPP model will help to prevent building collapse; are the major effects of PPP maintenance model on infrastructure.

It was also found that PPP maintenance contract if implemented will help to preserve the physical features of the building, thus, reducing need for regular maintenance. It was found that apart from the use of PPP, there should be a positive attitude of occupant towards emphasis on prevention over correction; for building to remain maintained. It was also found that there is an issue with the implementation of the current national building maintenance policy.

A weak but positive and significant relationship was found between the effects of PPP maintenance model and the limitations of current models.

5.2 Recommendations for the Study

From the findings and conclusion, the study makes the following recommendation

1. Engendering the culture of maintenance and adequate budgetary provision for maintenance work.
2. Planned and preventive maintenance programmed should be developed and frequently checked for compliance. This will lead to an attitudinal change from corrective to preventive maintenance type.
3. Building construction should be supervised properly to ensure compliance to clients' requirements and users' need. This will help reduce maintenance work during building project occupation.
4. To reap the full benefits of PPP in maintenance of public building. Government is a continuum; thus, the change of government should not affect existing or new methods of carrying out maintenance work. Innovative procurement methods such as PPP should be put in place to ensure that public assets are continually maintained for optimal performance and functioning of the users.

5.3 Contribution to Knowledge

From the findings, the following are the contribution of the research to knowledge;

1. This study will aid decision makers in making appropriate maintenance decision for the overall progress and performance of the agency/parastatal involved.
2. The study has provided a further understanding of the concept of PPP and maintenance.

3. The study has also added to the existing body of knowledge on public-private partnerships and maintenance as it has to do with construction management in the construction industry of the country.

5.4 Area for Further Research

The study recommends the following further research;

1. Similar study should be conducted to ascertain the drivers of PPP in maintenance of public infrastructure.
2. Further study could also be conducted to empirically examine the relationship between PPP in infrastructure maintenance and value for money.
3. Also, the role of adoption strategies for Implementing PPP in maintenance work across the country can be embarked upon.

REFERENCES

- Abiodun, J.A., & Adeyemi, S.K. (2020). Performance role models among public health facilities: an application of data envelopment analysis. *International Journal of Healthcare Management*, 13(3), 193-200. Doi: 10.1080/20479700.2017.1397379.
- Adama, J., Aghimien, D.O., & Fabunmi, C.O. (2018). Students' Housing in Private Universities in Nigeria: Influencing Factors and Effect on Academic Performance. *International Journal of Built Environment and Sustainability* 5(1), 12-20. DOI:[10.11113/ijbes.v5.n1.242](https://doi.org/10.11113/ijbes.v5.n1.242)
- Adebanjo, D. & Mann, R. (2000) 'Identifying Problems in Forecasting Consumer Demand in The Fast Moving Consumer Goods Sector., *Benchmarking: An International Journal*, 7(30), 223-230, Emerald, DOI: 10.1108/14635770010331397
- Adegoke, B. (2010). *Problems of direct labour projects procured in Lagos State*, Munich, GRIN Verlag, <https://www.grin.com/document/179103>
- Adejimi, A. (2005). Poor Building Maintenance in Nigeria: Are Architects free from Blames? Being paper presented at the ENHR International conference on "*Housing: New Challenges and Innovation in Tomorrow's Cities*" in Iceland between 29th June-3rd July, 2005
- Adeleye, S. I. (2009). Maintenance Practice in Nigeria, Policy, Budgeting and Legislative Issues". *A paper presented at Sensitization Campaign or Maintenance Culture, Organized by National Orientation Agency, Oyo State Directorate, Ibadan.*

- Adenuga, A.O. (2011). Assessment of factors affecting maintenance management of public hospital buildings in Lagos State, Nigeria. *Journal of Contemporary Issues in Real Estate*, 1 (1) 151-162.
- Adenuga, O. A., Odusami, K. I., & Faremi, J. O, (2006). Assessment of factors affecting maintenance management of public hospital buildings in Lagos state, Nigeria. *Department of Building, Faculty of Environmental science, University of Lagos, Nigeria*
- Adenuga, O. A. (2010a). Labour Composition for Maintenance Works in Public Hospital Built Environment in South-west, Nigeria. *Journal of Building Performance*, 1 (1), 83-97
- Adenuga, O. A. (2010b). Maintenance management practices in public hospital built environment: Nigeria case study. *Journal of Sustainable Development in Africa* 14(1), 185-201.
- Adenuga, O.A. (2012). Maintenance Management Practices in Public Hospital Built Environment: Nigeria Case Study. *Journal of Sustainable Development in Africa*, 14(1): 228–244.
- Adenuga, O.A., & Dosumu, O.S. (2012). assessment of procurement methods used for executing maintenance works in Lagos state. *Ethiopian Journal of Environmental Studies and Management EJESM*, 5(4), 477-483
<http://dx.doi.org/10.4314/ejesm.v5i4.S6>
- Adnan, H., Fauzi, Z.F.M.F., Rahmat, I., & Supardi, A. (2012). Maintenance Management For Public Infrastructure For Malaysian Local Authorities. *ARPN Journal of Engineering and Applied Sciences*, 7(11),1514-1522
- Ajanlekoko, J. S. (2001). *Sustainable Housing Development in Nigeria – The Financial and Infrastructural Implication*. Available at <http://www.fig.net/pub/proceedings/nairobi/ajanlekokocmws1-1.pdf>. Accessed on March 4, 2012.
- Akinkunmi, O. G., Aghimien, D.O., & Awodele, O.A. (2018). Appraising the use of labour-only procurement system for building construction in Nigeria. *Organization, Technology and Management in Construction*, 10, 1719–1726
- Ali, A.S., Chua, S.J.L., and Ag Ali, D.B. (2016). Issues and challenges faced by government office buildings in performing maintenance work. *Jurnal Teknologi*, 78(11),11-23.
- Ali, A.S. (2009). Cost decision making in building maintenance practice in Malaysia. *Journal of Facilities Management*,7(4), 298-306

- Al-Najjar, B., Alsyouf, I., Salgado, E., Khoshaba, S., & Faaborg, K. (2001). *Economic Importance of Maintenance Planning when using Vibration-Based Maintenance Policy*, Växjö University
- Andrew, S., & Halcomb, E.J. (2012). Mixed Method Research. In: Borbasi, S., & Jackson, D. (Eds),. *Navigating the maze of research: enhancing nursing & midwifery practice*. 3rd ed. Marrickville, New South Wales: Elsevier.
- Babatunde, S.A. (2018). Government spending on infrastructure and economic growth in Nigeria. *Economic Research-Ekonomska Istraživanja*, 31(1), 997-1014. <https://doi.org/10.1080/1331677X.2018.1436453>
- Bhat, A. (2019). *Research Design: Definition, Characteristics and Types*. Retrieved on (19th June, 2019) from: <https://www.questionpro.com/blog/research-design>.
- Bivens, J. (2014). The Short- and Long-Term Impacts of Infrastructure Investments on U.S. Employment and Economic Activity. *Economic Policy Institute*. 1 July 2014. Retrieved from: www.epi.org
- Brian V. W. (2018). Research design and methods, Part I. *A paper presented at the 50th Anniversary of University of the Western Cape*.
- British Columbia Ministry of Municipal Affairs. (1999). *Public private partnership; A guide for Local Government*.
- British Standard Institution (BS 3811) (1984). *Glossary of general terms used in maintenance organisations*. Blackwell Science Ltd, Oxford. U.K.
- British Standards Institution, *BS 3811, (1964). Glossary of Terms Used in General Maintenance Organisation*
- Chilala, R. N. & Mulenga, M. (2017). Challenges in Implementing Public Private Partnerships (PPPs) Projects in the Road Sector in Zambia. *Global Journal of Researches in Engineering*, 17(3), 1-7
- Chua, S. J. L., Ali, A. S., & Alias, A. (2014). Procurement Method Selection for Building Maintenance Projects: The Case of Malaysian Public Universities. *World Journal of Engineering and Technology*, 2, 7-13. <http://dx.doi.org/10.4236/wjet.2014.23B002>
- Cobbinah, P. J. (2010). Maintenance of Buildings of Public Institutions in Ghana, Case Study of Selected Institutions in the Ashanti Region of Ghana. *M.Sc. Thesis, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana*.
- Cooper, D., & Schindler, P. (2014). *Business Research Methods* (14th ed.). New York, NY: Irwin/ McGraw-Hill.

- Creswell J. W. (2014). *Research design: Qualitative, Quantitative, and Mixed Methods approaches*. International Student Edition, (4th Ed), London, Sage.
- Dabak, P. D. (2014). Public-Private Partnership: The Answer to Nigeria's Development Challenges. *Journal of Economics and Sustainable Development*, 5(22), 143-147.
- Davis, P., Love, P., & Baccharini, D. (2008). *Building Procurement methods.Report-Construction Innovation*. Retrieved on (28th November 2019) from;http://www.construction-innovation.info/images/pdfs/Research_library/ResearchLibraryC/2006-034-C/reports/Report_-_Building_Procurement_Methods.pdf
- Dayo, A., Adepoju, B., & Oyeola, A. (2019). *Public Private Partnerships: The Prospects for Standard Infrastructural Developments in Nigeria*.
- Demirag, I., Khadaroo, I., Stapleton, P., & Stevenson, C. (2010). *Public Private Partnership Financiers' Perceptions of Risks*. Edinburgh: The Institute of Chartered Accountants of Scotland.
- Department of the Environment (1972). *Report of the Committee on Building Maintenance*, HMSO.
- Designing buildings Wiki (2021). Maintenance. Available at: <https://www.designingbuildings.co.uk/wiki/Maintenance>
- Duffuaa, S. O., Raouf, A., & Campbell, J. D. (1999). Planning & Control of Maintenance system: modeling and analysis.
- Ebekozien, A. (2021). Maintenance practices in Nigeria's public health-care buildings: a systematic review of issues and feasible solutions. *Journal of Facilities Management*,19(1), 32-52
- Edwards, S. (2010) *Construction Management Ideologies*, 2nd edn. New York: Chapman & Hall.
- Eke, E.C., Musa, S., Fashubaa, T.O., & Abass, J.O. (2017). An Assessment of Maintenance Culture on Public Buildings in Nigeria (A Case Study of Osun State). *IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE)* , 14(5), 53-57.
- Elisha, C. (2018). Maintain Operate Transfer (MOT) PPPs for Road Maintenance in Nigeria. Retrived from : <https://www.linkedin.com/pulse/maintain-operate-transfer-mot-ppps-road-maintenance-nigeria-elisha>

- Eti, M. C., Ogaji, S.O.T., & Probert, S. D. (2004). Implementing total productive maintenance in Nigerian manufacturing industries. *Applied Energy*, 79 (40), 385 – 401.
- European PPP Expertise Centre (2015). PPP Motivations and Challenges for the Public Sector Why (not) and how. EPEC.
- Eze, C.E., Ugulu, R.A., Egwunatum, S.I., & Awodele, I.A. (2021). Green Building Materials Products and Service Market in the Construction Industry. *Journal of Engineering, Project, and Production Management*, 11(2), 89-101
- Fagbenle, O.I., Adeyemi, A.Y., & Adesanya, D.A. (2004). The impact of non-financial incentives on bricklayers' productivity in Nigeria. *Construction Management Economics*, 22, 899-911.
- Fellows, R. and Liu, A. (2015). *Research Methods for Construction* (4th ed.). Wiley Blackwell.
- Halcomb, E., & Hickman, L. (2015). *Mixed methods research*. Nurs Stand, 29, 41–47
- Hampton, G., Baldwin, A.N., & Holt, G. (2012). Project delays and cost: stakeholder perceptions of traditional v. PPP procurement. *Journal of Financial Management of Property and Construction*, 17(1), 73-91
- Hesse-Biber, S.N., & Leavy, P. (2011). *The Practice of Qualitative Research* (2nd ed.). California, US: Sage.
- Hupjé, E. (2020). 9 types of maintenance: how to choose the right maintenance strategy. Retrieved from: <https://roadtoreliability.com/types-of-maintenance/>
- Interplay Learning (2020). Multi-Family Maintenance: What are the Different Types of Maintenance?. Retrieved from: <https://www.interplaylearning.com/blog/different-types-of-maintenance>
- Ipingbemi, O. (2010). Facility Management Unpublished MSC Housing Development and Management Lecture Notes. University of Ibadan, Nigeria.
- Ivankova, N.V. (2006). Using mixed methods sequential explanatory design: from theory to practice. *Field methods*, 18, 3–20
- Jamali, D (2004). Success and failure Mechanism of public private partnership (PPPs) in developing countries: Insight from Lebanon context. *International Journal of Public Sector Management*, 17 (5), 414-430
- Kelly, A. (2014). *Maintenance planning and control*. Butterworth & Co., England

- Khan, R.A., Liew, M.S., & Ghazali, Z.B. (2014). Malaysian construction sector and Malaysia vision 2020: developed nation status. *Procedia-Social and Behavioral Sciences, Antalya*, 507-513.
- Kirshenblatt-Gimblett, B. (2006). *What is Research Design? The Context of Design. Performance Studies Methods Course Syllabus*. New York, NY: New York University Press.
- Komonen, K. (2002). A cost model of industrial maintenance for profitability analysis and benchmarking. International. *Journal of Production Economics*, 7, 15-31.
- Krejcie, R.V., & Morgan, D.W. (1970). Determining Sample Size for Research Activities. *Educational and Psychological Measurement*, 30, 607-610.
- Kunya, S.U. (2012). Maintenance Management Unpublished M.Tech Construction Management Lecture Notes, Building programme, faculty of Environmental Technology, Abubakar, Tafawa Balewa University of Technology, Bauchi, Nigeria.
- Lateef, O.A. (2010). Case for alternative approach to building maintenance management of public'Universities. *Journal of Building Appraisal*, 5(3), 201-212.
- Manu, C. A. (2015). The effects of work environment on employees' productivity in government organizations. A case study of Obuasi municipal assembly. *Published MBA thesis*, Kwame Nkrumah University of science and technology, Kumasi, Ghana.
- Masterman, J. W. E. (2002). *An Introduction to Building Procurement Systems* (2nd ed.). London; New York: Spon Press.
- Mittal, A., & Kalampukah, P.K (2009). Partnership Challenges in Achieving Common Goals- A Study of Public Private Partnership in E-Governance Projects, Unpublished M.SC Thesis, Umea School of Business
- Mugenda, O., & Mugenda, A. G. (2003). *Research Methods: Quantitative and Quantitative Approach*, Nairobi. Acts press.
- Nigeria Infrastructure Advisory Facility (2017). Infrastructure Concessions Regulatory Commission (ICRC). Draft PPP Manual for Nigeria.
- Nkoli, U.A. (2011). Human Resource Management and Productivity in Nigeria Public Sector. Published MBA thesis, UNN.
- Nkrumah, E.N.K., Stephen, T., Takyi, L., & Ana, O. A. (2017) Public Infrastructure Maintenance Practices in Ghana. *Review Public Administration Management*, 5,(3), 1-9. doi:10.4172/2315-7844.1000234

- Obi-Anike, O. H., Ofobruku, S.A., & Okafor, C. N. (2020). Public-Private Partnership and Infrastructural Development: Implications for Economic Diversification in Abuja, Nigeria. *Academy of Strategic Management Journal*,19(1), 1-18. Available at: <https://www.abacademies.org/articles/publicprivate-partnership-and-infrastructural-development-implications-for-economic-diversification-in-abuja-nigeria-8949.html>
- Odediran, S. J., Opatunji, O. A., & Eghenure, F. O. (2012). Maintenance of Residential Buildings: Users' Practice in Nigeria. *Journal of Emerging Trends in Economics and Management Sciences (JETEMS)*, 3(3), 261-265.
- Ogungbile, J.A., & Oke, E.A. (2015). Assessment of facility management practices in public and private buildings in Akure and Ibadan cities, South-Western Nigeria. *Journal of Facilities Management*, 13(4) 366-390, doi: 10.1108/JFM-11-2014-0037.
- Ojara, E.S. (2013). The Challenges of Housing Maintenance in Nigeria. *Unpublished HND thesis, Covenant University, Ota, Ogun State. Nigeria*
- Ojo, O (2009). Impact Assessment of Corporate Culture on Employee Job Performance. *Business Intelligence Journal*, 2(2), 388-397
- Ojo, S. O., Adeyemi, A. Y., and Fagbenle, O. (2006). The Performance of Traditional contract procurement on Housing projects in Nigeria. *Civil Engineering Dimension*, 6 (2), 81-86.
- Oladimeji, A.B. (1996). Budgeting, Costing and Cost Control in Maintenance Engineering and Management. Being a paper delivered at a 3-Day Course organized by the Nigerian Society of Engineers, Osogbo Branch at the Federal Polytechnic Ede, Osun State, 3rd – 5th July.
- Oladun, M. M. (2012). Innovative distribution strategies and performance of selected multinational corporations (MNCS) and domestic manufacturing firms in Nigeria. *Published PhD thesis, Covenant University, Ota, Ogun state, Nigeria.*
- Olatunji, S. O., Aghimien, D.O., Oke, A. E., & Temitope, A (2016). Assessment of maintenance management culture of tertiary institutions in Nigeria. *Civil and Environmental Research*, 8(6), 98-105.
- Olele, C.A. (2016). The Challenges of Public Private Partnership (PPP) Projects in a Developing Country: The Case Study of the Lekki Toll Road Infrastructure Project in Lagos, Nigeria. *International Journal of Ground Sediment & Water*, 04,193-204.

- Onyenekenwa, C. E. (2011). Nigeria's Vision 20:2020-Issues, Challenges and Implications for Development Management. *Asian Journal of Rural Development*, 1, 21-40.
- Oyedele, O.A (2012). Public-Private Partnership (PPP) and Infrastructure Provision in Nigeria. *Conference paper*. Retrieved on (27 November, 2019) from <https://www.researchgate.net/publication/232596373>
- Oyedele, O.A. (2006). Effects of Waste Dumps Values of Adjoining Properties: A case study of Abule-Egba Waste Dump. Being Unpublished Thesis Submitted to the Senate of University of Ibadan, Nigeria, in partial fulfillment of the conditions for the award of Master of Science in Housing
- Oyefeko, S. (1999). Strategic Approach to Maintenance Management Practice. *Seminar/Workshop by the Nigerian Institute of Building, Yaba College of Technology, Lagos*.
- Oyigbo, T. E., & Ugwu, O. O. (2017). Appraisal of key performance indicators on road infrastructure financed by Public Private Partnerships in Nigeria. *Nigerian Journal of Technology*, 36(4), 1049 – 1058.
- Patil, N.A., & Laishram, B.S. (2016). Sustainability of Indian PPP procurement process: Development of strategies for enhancement. *Built Environment Project and Asset Management*, 6(5), 491-507
- Pirvu, D., & Voicu-Olteanu, C. (2009). Advantages and Limitations of the Public Private Partnerships and the Possibility of Using Them in Romania. *Transylvanian Review of Administrative Sciences*, 5(27), 189-198
- PPP knowledge lab (2018). Inadequate maintenance. Retrieved from: <https://pppknowledgelab.org/guide/sections/13-inadequate-maintenance>
- Rioja, F. (2012). What Is the Value of Infrastructure Maintenance? A Survey. The 7th Annual Land Policy Conference: Infrastructure and Land Policies, sponsored by Lincoln Institute of Land Policy, June 4–5, 2012, 347-365
- Rizal, Y. (2017). Twelve years of Scottish school public private partnerships: are they better value for money? *Journal of public procurement*, 17(2), 187-228.
- Ali, H., Jailani, J., Rahman, I.A., & AL-fadhali, N. (2020). Building maintenance practices in Malaysia: a systematic review of issues, effects and the way forward. *International Journal of Building Pathology and Adaptation*, 38(5), 653-672
- Rufus, A. & Bufumoh, P., (2017). Critical Infrastructure Decay and Development Crises in Nigeria. *Global Journal of Human-Social Science*, 17(2), 59-66

- Saidu, I., & Shakantu, W.M.W., (2016). A Study of the Relationship between Material Waste and Cost Overruns in the Construction Industry. The 9th CIDB Postgraduate Conference Cape Town, South Africa. Emerging trends in construction organisational practices and project-management knowledge area. Edited Windapo, A.O., 124-134, Feb, 2-4, 2016.
- Service Work global (2019). Types of PPP Contracts. Retrieved from: <https://www.swg.com/can/insight/ppp-resources/types-of-ppp-contracts/>
- Shorten, A., & Smith, J. (2017). *Mixed methods research: expanding the evidence base. Evid Based Nurs*, 20 (3), 74-75. doi: 10.1136/eb-2017-102699.
- Tan, W.C.K. (2011). *Practical Research Methods*; Pearson Custom: Singapore.
- Tan, Y., Shen, L., & Langston, C (2012). A casual relationship between building maintenance market and GDP: Hong Kong study. *Journal of Facilities Management*, 10(3), 241-251
- The constructor (2019). Partnership (PPP) Construction Projects – Types and Benefits. Retrieved from: <https://theconstructor.org/construction/public-private-partnership-ppp-construction-projects-types-benefits/1319/>
- The Constructor (2021). Objectives of Building Maintenance Works. <https://theconstructor.org/building/building-maintenance-objective/6901/>
- Treasury, H.M. (2012). *A new approach to public private partnerships*. Crown, London, p 15
- Trimmer, & Kidston, N. (2003). *Assessing procurement, Trimmer CS and The Housing Corporation, London*.
- Trochim, W.M.K. (2020). *What is the Research Methods Knowledge Base?*. Available at: <https://conjointly.com/kb/>
- Ugwu, O. O., & Attah, I. C. (2016). An appraisal of Construction Management in Nigeria. *Nigerian Journal of Technology*, 35(4), 754 – 760
- Ugwu, O.O., Okafor, C. C., & Nwoji, C. U. (2018). Assessment of Building Maintenance in Nigerian University System: A Case Study of University of Nigeria, Nsukka. *Nigerian Journal of Technology (NIJOTECH)*, 3(1), 44 – 52
- Umar, K.E, Obidike, C.P., & Ihezukwu, V.A. (2104). Maintenance culture and sustainable economic development in Nigeria: Issues, problems and prospects. 2(11), 6

- United Nations (2008). Guidebook on Promoting Good Governance In Public-Private Partnerships. Available at: <https://unece.org/fileadmin/DAM/ceci/publications/ppp.pdf>
- Usman, A & Egbewole, A.W. (2011). Public Private Partnership and the Development of Osun State Nigeria: Issues and Options. *Journal of Asian Scientific Research, Asian Economic and Social Society*, 1(5), 220-228
- Usman, N.D., Gambo, M.J., & Chen, J. A. (2012). Maintenance culture and its impact on the construction of residential buildings in Nigeria. *Journal of Environmental Science and Resources Management*, Vol 4
- Wisdom, J., & Creswell, J.W. (2013). *Mixed methods: integrating quantitative and qualitative data collection and analysis while studying patient-centered medical home models*. Rockville, MD: Agency for Healthcare Research and Quality.
- World bank group (2019). *Management/Operation and Maintenance Contracts*. Retrieved on 28th November, 2019) from <https://ppp.worldbank.org/public-private-partnership/agreements/management-and-operating-contracts>
- World bank group (2020). *Management/Operation and Maintenance Contracts*. Retrieved from: <https://ppp.worldbank.org/public-private-partnership/agreements/management-and-operating-contracts>
- World Economic Forum (2017). Retrieved from: <https://www.weforum.org/reports/africa-competitiveness-report-2017>
- Zakari, M. (2007). Public-Private Partnership in Library and Information Services; in Nigerian Libraries for the future: progress, Development and partnerships. *Uyo: Nigerian Library Association, 45th Annual National Conference and AGM*.
- Zeeshan, T. (2020). Maintenance of Buildings: Meaning, Aims and Types. Retrieved from: <https://www.yourarticlelibrary.com/building-engineering/maintenance-of-buildings-meaning-aims-and-types/85548>
- Zubairu S.N. (2010). The National Maintenance Policy for Nigeria - The architect's perspective.