



Impacts of Culture, Design and Policy on Maintenance of Public Buildings in Nigeria- A Review

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Abstract: Building Maintenance is indispensable not only to uphold building functionality but also to minimize maintenance costs and to ensure environmental safety of the occupants. Public buildings are those undertaken by the public authority (the Federal, State or Local Government) primarily for the benefit of the society at large. Public buildings challenges have been noted to be copious and comprise of funding, technology for development, maintenance and design. Maintenance studies in the developing countries especially Nigeria have established low level of maintenance consciousness at the design stage by the designers (Architects). Equally, there is generally poor maintenance culture among both government and the populace; and there is the lack of effective national maintenance policy, laws and regulations to compel both State Government and the built environment professionals to do the needful as regards maintenance. Therefore, this paper establishes the link between culture, design and policy and underscores their combined importance to ensure near to maintenance free infrastructural development with a view to informing the policy on sustainable public infrastructure (buildings) development in Nigeria. This review is significant in the sense that it presents a harmonized information bordering the tripod of culture, design and policy influences on maintenance of public buildings and built environment at large. Such information is vital in making sustainable decisions in subsequent development.

Keywords: Culture, Design, Policy, Public buildings, and Maintenance

1.0 Introduction

Maintenance has been affirmed to be very important in the literature. It is necessary not only to uphold building functionality but also to minimize maintenance costs and to ensure environmental safety of the occupants (Abdullah Sani, et al, 2011). Public buildings are those undertaken by the public authority (the Federal, State or Local Government) primarily for the benefit of the society at large. The distinguishing aspect of a public property from private estates is the right of any member of the public to access it (Ikpo, 2009). Public buildings maintenance assessment in Nigeria has been reputed as very poor, suffering from lack of fund and total negligence by the scholars (Adenuga and Iyagba, 2005 cited in Eke et al, 2017; Owolabi et al, 2014). Reasons adduced for these include lack of attention to level of technology, cultural background and environment during design stage, dearth of skilled maintenance experts, misuse of facility by occupants, bribery and corruption, low quality of maintenance work, lack of ethics in maintenance effectiveness, lack of supervision from leaders, delays in repairing and replacing asset, failure of the management to provide clear policies and standards to guide the maintenance staffs, insufficient information of maintenance, and lack of commitment to maintenance plan (Abdullah Sani, et al, 2011; Uma and Obidike and Ihezukwu, 2014; Eke et al, 2017, Ugwu, and Okafor, and Nwoji, 2018). Thaheem and De Marco, (2014) noted that repair and maintenance (R&M) of buildings and structures are inevitable due to aging, wear and tear, design and construction defects, and the consequences of building components exposure to environmental agents of overtime.

Infrastructure construction projects worth in Nigeria has been rated in Trillions of Naira (Ugwu, and Okafor and Nwoji, 2018). This necessitates an establishment of proper maintenance strategies for realization of economic values of such huge investment (Ugwu and Attah, 2016). Public buildings play a major role in the development of a nation. It can impact either positively or negatively on productivity, way of life, behavioral and thinking pattern, and general lifestyle. Despite these, Nigeria governments has been adjured to exhibit poor maintenance practice and culture (Zubairu, 2010 cited in Izobo-Martins, and Ekhaese, Ayo-Vaughan, 2018). Moreover,

public buildings are allowed to dilapidate to unusable levels before maintenance plans are made to preserve its economic value and durability. When maintenance activities of such facility delayed extensively, it leads to total overhaul and reconstruction, resulting in a serious economic waste (Cobbinah, 2010). The obvious problem here is that of lack of integration of maintenance plans into the current project delivery process (i.e. planning, design, construction, operation and use).

Maintenance culture, unique to each organization has been acknowledged as an important aspect for increasing the quality of maintenance work. It is a substitute for improving maintenance obligation and creating maintenance awareness among all parties in maintenance management (Abdullah Sani, et al, 2011). The study by Abdullah Sani, et al, (2011) prescribes that cultivation of maintenance culture should originate from the change of mindsets and attitudes, to promoting continuous knowledge and skill enhancement, and performance improvement in maintenance activities. Change influence on culture requires breaking age-long casts of poor perception, old patterns of inappropriate behaviour, and outdated beliefs and values. Though studies pertaining to culture are abundant in business and manufacturing sectors, little effort has been put to study culture in the construction industry, particularly in maintenance.

Design influences the performance and physical characteristics of the building as well as its durability to withstand environmental elements and social interferences (Ramly, and Ahmad, and Ishak, 2006; cited in Al Rubaiey and Md Ulang and Baharum, 2014). Izobo-Martins and Ekhaese and Ayo-Vaughan, (2018) challenge the observed culture of not putting maintenance into consideration when designing among the Architects selected for study. The study further noted that most public buildings were designed without maintenance manual and most users lack maintenance culture, all of which reduce the life of the building. According to Iyagba, (2005) although it is an impossible act to design or construct buildings which are maintenance free. However, maintenance issues can be minimized by good architectural design, standard construction, using appropriate methods and styles ensuring that they are carried out by skilled experts or competent craftsmen doing this by using suitable codes of installation, requisite building materials and methods. According to Faremi, and Adenuga, (2012) nature of building materials, method and quality of construction, environmental conditions and the use of the buildings make public building components susceptible to defects or deterioration. This has ripple effects on the structural health and functional integrity of the building infrastructure system. Efficient and effective performance of public buildings will require consideration of cost of maintenance in a yearly budget and overall construction processes.

Studies have established lack of effective national maintenance policy, laws and regulations to compel both state government and Architects to provide relevant information necessary for easy maintenance operation (Adedokun, 2011; Izobo-Martins, and Olotuah, and Adeyemi, 2015; Elenwo, and Amanda, and Izobo-Martins, 2016). There is majorly no maintenance documentation and maintenance manual in the office or on projects of the most studied Architects. Public buildings maintenance is handled like maintenance of individual buildings since many professional are only using their discretion and experiences over time. Elenwo and Amanda and Izobo-Martins, (2016) reveal that the challenges in the public buildings are abundant and comprise of funding, technology for development, maintenance and design. Therefore, this paper establishes the link between culture, design and policy and underscores their combined importance to ensure near to maintenance free infrastructural development with a view to informing the policy on sustainable public infrastructure (buildings) development in Nigeria. This review is significant in the sense that it presents a harmonized information bordering the tripod of culture, design and policy influences on maintenance of public buildings and built environment at large. Such information is vital in making sustainable decisions in subsequent development.

2.0 Conceptual Issues

2.1 Public buildings maintenance

Public buildings are those undertaken by the public authority (the Federal, State or Local Government) primarily for the benefit of the society at large. The distinguishing aspect of a public property from private estates is the right of any member of the public to access it (Ikpo, 2009). Their effective maintenance enhances building functionality, minimizes maintenance costs and ensures environmental safety of the occupants (Abdullah Sani, et al, 2011). Owolabi et al, (2014) assessed the effectiveness of maintenance practices in public schools in Kaduna state Nigeria. The positive outcome of the study was maintenance awareness/sensitization being created. Besides, lack of proper phasing of maintenance task, uneconomical maintenance management practice, poor maintenance contract management, lack of availability of materials and the incidence of in accurate

estimate were all reported. Izobo-Martins, Olotuah, and Adeyemi, (2015) investigated maintenance policy and strategies in Secondary school in Ogun State Nigeria and reported problem of lack of good maintenance programs for the schools, widespread use of ad-hoc and reactive maintenance management practices, wrong maintenance process, all resulting from lack of understanding/maintenance skill on the part of the managers. The study observed that there is no maintenance policy in place for the school buildings. It was established that governments do not have established maintenance strategies and policies, hence the study recommends that there should be specified standard maintenance policies and strategies framework for public secondary schools buildings as well as public buildings in Nigeria. Maintenance issues become more critical for public buildings when the facility is operated at its optimum capacity to serve the public intensively (Al Rubaiey and Md Ulang and Baharum, 2014).

2.2 Culture and Maintenance

The definition of maintenance culture has not been described in detail by the literature. Notwithstanding its scope is very similar to that of culture in other fields. Culture in this review is recognized as maintenance culture. According to Mark et al, (2006), the concept of maintenance culture is the internal environment between management and staff in managing maintenance effectively through the sharing of ideas, beliefs and values for each member in organization. Maintenance culture is a way of thinking and behaving that can be drawn based on the actions taken by each individual in maintaining, preserving and protecting a system, equipment and structures. Cultural beliefs, values, norms, practices and attitudes related to maintenance work should be embedded in every individual organization carrying out maintenance services (Suwaibatul et al, 2010).

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Examining maintenance culture in relation to public building maintenance, in spite the impact of public buildings on productivity, way of life, behavioral and thinking pattern, and general lifestyle; public building maintenance culture has been adjured to be poor (Zubairu, 2010 cited in Izobo-Martins, and Ekhaese, Ayo-Vaughan, 2018). In most instances, Public buildings suffered maintenance neglect to the point of dilapidation before plans are made to preserve its economic value and durability. The study by Uma and Obidike and Ihezukwu, (2014) notes on post-independence channelization of large chunk of the country's resources to transportation infrastructure construction, industries, government administrative buildings for ministries and parastatals, schools, colleges and universities in Nigeria. However, due to very low level of consciousness of maintenance culture among tiers of government and the nationals; beautiful edifice once applauded shortly turned deplorable and even collapse. Haruna (2009) cited a prominent example of the National Arts Theatre, Iganmu, Lagos, an architectural masterpiece built for hosting FESTAC in 1977. The edifice lost its grandeur and patronage owing partly to lack of maintenance culture, thereby appearing like a ghost place. Uma and Obidike and Ihezukwu, (2014), observed attitudes of government that embarks on public goods provision but neither care so much for the quality of investment projects nor do they ensure that such projects live up to their life span before gradually turning deplorable. Problem of maintenance culture identified with the government include de-emphasizing the importance of project sustainability and lack of incorporating long term facility management in all its major projects (Olatunde, 2009). Others are lack of continuity in government policies, and little commitment to monitoring projects development. It is onus on the government to facilitate maintenance culture through the points above.

Hence, Kunya (2012) observed the defects in housing facilities. He catalogued peeling of wall surface, rising dampness in substructure, floor slab failure and doors and windows defect, leaking roof while foundation failure and sagging of beam.... He further advocated that maintenance culture requires the correct diagnosis of defects, current remedial measures, sound technical knowledge of material usage, management resources as well as the formulation and implementation of integrated plan and policies to sustain utility. The absence of these qualities has led to the decay of the nation's physical, social, aesthetic and economic environment. The users do not always make use of the property and the services in good condition, often users do not obey the information contained in the maintenance manual of the building if it exists at all (Siyanbola et al., 2013 cited in Olanrewaju and Anifowose, 2015). Most property owners sometimes endeavour to keep maintenance expenditure to the least, eliminating the consequences of the long term effect of such action.

The study by Adedokun, (2011) indicated that there was a significant relationship between maintenance of facility and development; and also that education has a significant impact on maintenance culture. Therefore, it

recommended that people should be educated and encouraged to adequately and properly maintain facilities in their care so as to facilitate rapid process of development. Education phase of maintenance culture development starts with inclusive project initiation. When government carries people along in projects development and they are educated as to the aims and objectives of such, people's morale is very high and there is tendency for them to sustain such development (Adedokun, 2011). Training members of the community (users and government workers) who are the beneficiaries of such facilities stating their civic roles in maintaining the projects is an extremely important integral part of maintenance culture capacity building.

In the design of public buildings, it is important to reckon with the maintenance culture of the users. In Nigeria, there is the general tendency towards neglect, indifference or a vandalistic attitude regarding government property as against private-owned properties (Ikpo, 1990).

2.3 Design process and maintenance implications

Sufficient planning for maintenance in the early stages of Architects' design could protect the building from severe defects and make the maintenance process an easy task in future stages of design and throughout the building's life cycle. Design influences the performance and physical characteristics of the building as well as its durability to withstand environmental elements and social interferences (Ramly, and Ahmad, and Ishak, 2006; cited in Al Rubaiey and Md Ulang and Baharum, 2014). Research has linked building design, life cycle and maintenance (Wood, 2003, cited in Izobo-Martins, and Ekhaese, Ayo-Vaughan, 2018). Building life expectancy is also affiliated with the excellence and extent of maintenance. Faulty design can increase the maintenance activities of a building and also shorten the lifespan of a building (Ishak, Chonan, & Ramly, 2007).

Management of any process involves assessing performance, and maintenance management of buildings is no exception (Zubairu, 2010). Investigating the impact of architectural design parameters on building maintenance, Izobo-Martins and Ekhaese and Ayo-Vaughan, (2018) emphasized on Architects' duties which are: application of maintenance strategies, use of specification documents, specification of building population, educating the building users, use of indoor and outdoor signage, building orientation, artificial ventilation and lighting, space allocation, energy saving fixtures and fittings, and shape of building envelope; as factors to be duly considered by Architects while handling building design for easy maintenance.

The combined roles of design and construction team presided over by the Architect entail project feasibility study, excellent analysis (brief and site), design conceptualization, cost projection and adjustment, design evaluation and maintenance, production drawings with relevant and adequate detailing and proper material specifications, services and security installation, construction supervision and decoration/finishes, as-built drawing and maintenance schedule/manual. At each of these stages, of all the paramount design requirements: organization of functional spaces, flexibility, structural stability, statutory compliance, aesthetics, symmetry and balance; Architects must employ sustainable strategies for easily maintained development.

The maintenance of a structure affects its sustainability. Sustainability is a key factor to consider in design; not only for environmental reasons, but it also promotes architectural quality and it has economic advantage (ECDGE, 1999). Sustainability allows for economic savings through efficient design with reduction in the buildings' environmental footprint (Braganca, Vieira, & Andrade, 2014). The importance of considering sustainability in the design stage of a project curbs the subsequent need for finding long term solutions for issues that may arise.

Che-Ani, et al, (n.d) recognized four classical areas where design and construction processes impact post-occupancy maintenance of any building, they are: design issues, construction and management factors in design, construction phase and user's feedback. Architectural design issues in question consist of: design errors and omissions or carelessness leading to unplanned maintenance among members of construction team; crucial matter of right and appropriate materials (Non Availability or No Alternate of material); and poor detailing (Che-Ani et al, n.d). Construction and management factors in building design feature: understanding of the construction management necessary for intelligent design work (Ambrose 1992 cited in Che-Ani et al, n.d); management of available time period for design in order to avoid the faults in design which could occur in case of time shortage; communication gap among the building trade professional which results in faults in design; and construction methods and defects. The Construction phase and user's feedback strictly address requisite construction management experience and design evolution premised on user's participation (Inclusivity) respectively.

A new dimension to maintenance strategy application at design stage introduced by Al Rubaiey and Md Ulang and Baharum, (2014) is the experience of the designer. Experience plays an important role in applying the

factors affecting maintenance during the different stages of design. Each project has its own set of circumstances that differ from other projects. As such, special treatment based mainly on experience is required. The study further reveal that maintenance functions is an integral part of the design process and post-occupancy stage. Thermal expansion was highly rated as most prominent maintenance problem at post occupancy stage. Others are paint decay, dampness, cracks and stain.

Architects' proficiency begins to show at post occupancy stage of their designs. If the architect specifies sustainable materials and designs a sustainable building, it will achieve reduction of ultimate life-cycle cost of the building. A sustainable approach to design will require an integrated design process and a more involved approach rather than a conventional design process. (Braganca, Vieira & Andrade, 2014). Likewise, a high quality design will ensure maximum and efficient performance of building through its life cycle.

Ramly, (2006) relating building design and maintenance suggests four sections of the building designs which require due consideration. These are;

- i. Building Exterior; Wall, floors, roofs, doors and windows;
- ii. Internal finishes; Ceiling, wall and floor finishes;
- iii. Special design features; Decorative elements for doors, glass, windows, air vents etc. and
- iv. Cleaning and housekeeping of building components. The study explained that the designer must have proper knowledge of the use of specified materials and the consequences they have.

Planned materials selection during the design phase could help prepare for maintenance functions in future stages of post-occupation. The responsibility of selecting materials is often scattered between many parties in construction projects. While this responsibility is mostly placed on the architect, other parties such as civil engineers, mechanical engineers, electrical engineers and decorators are also partially involved in material selection and maintenance functions. The architect should know every single detail of the project and extend his or her knowledge to predict which parts of the facility will require special maintenance in further stages of the design.

Maintainability indices for design reference according to Ikpo, (2009) consist of: accessibility, maintenance manual, available technology, economic index, and reliability of components. Design accessibility for maintenance stress the need to ensure that parts of the building where repair and maintenance work would be necessary at post-occupancy stage must be provided with easy access. Building form should not be so complicated to hinder maintenance access. For instance, access to the headroom for routine Cobwebs cleaning.

Maintenance manuals are common features of electro-mechanical apparatuses. Even with the position of the National Building Code, this feature evades the building construction sector. Maintainability is defined with a condition that the remedial measure must follow the prescribed procedures. These procedures constitute manuals, but are never considered in building production, except for items falling under services. The implication is that building surveyors require greater time to evaluate the defects before embarking on repairs in the absence of the basic guide – the manual. The choice of alternative materials or components to replace a defective unit equally becomes problematic.

Technology provides solutions to the problems resulting from the combination of compatible and incompatible materials in building design. Also, technical knowledge and acquired skills on the part of artisans are components of the technological index. In specifying building components, due consideration should be given to the possibility of procuring each one in the event of future failure, as well as the availability of installation skill (Ikpo, 2009).

On the economic index, the ideal practice to overcome its associated problem is the inclusion of projected maintenance cost in the total construction cost. Life cycle costing has not given prominence in the Nigerian construction industry.

Reliability and maintainability are regarded as complementary features of a system (Barringer and Associates, 2001). Reliability measures the durability of an item, or building as a whole. It is the probability that an item would perform its design function within a stated time frame – usually the design life. Reliability has to do with the availability of the system, whereas maintainability measures the unavailability or unreliability.

Realistic maintainability appraisal hinges on the available data. Architects should make available the properties and characteristic features of items or components specified in design to the client for easy future maintenance.

Finally, Izobo-Martins and Ekhaese and Ayo-Vaughan, (2018) posit that, in order to reduce maintenance cost of a building from the inception stage of the design, the architect should have proper knowledge of space and cost management. They should be abreast with all the changing trends and materials in the construction industry in order to make proper decisions that will save cost and reduce wastage of resources and materials. This will give value to the building design and help increase the life cycle of the building. Standard measurement should be applied at the initial stage of design in order to avoid wastage of materials (Izobo-Martins and Ekhaese and Ayo-Vaughan, 2018).

2.4 Policy Impacts on Maintenance

Infrastructural development with well planned maintenance is one of the major characteristics of a developed nation (Ugwu, and Okafor, and Nwoji, 2018) and policies and regulations dictate their repair and maintenance (R&M) decisions. Conversely in the developing countries, diverse external factors such as: lack of budget, enforcing regulation and building standards to name a few determine these decisions (Thaheem, and De Marco, 2014)

The weak or lack of effective national maintenance policy, laws and regulations has been affirmed (Adedokun, 2011; Izobo-Martins, and Olotuah, and Adeyemi, 2015; Elenwo, and Amanda, and Izobo-Martins, 2016). Maintenance of public buildings should be based on policies and strategies that provide the modus operandi for organizational performance. According to Adenuga and Ibiyemi, (2009), this will provide an appropriate basis for preparing budgets that meet the actual maintenance need.

Owolabi et al, (2014) assessed the effectiveness of maintenance practices in public schools in Kaduna state Nigeria. The positive outcome of the study was maintenance awareness/sensitization being created. Besides, lack of proper phasing of maintenance task, uneconomical maintenance management practice, poor maintenance contract management, lack of availability of materials and the incidence of in accurate estimate were all reported.

Policy on standard maintenance practice is therefore vital for setting acceptable guide, regulates the activities of maintenance stakeholders and enforce compliance among government tiers, professional bodies, manufacturers and the entire populace (Izobo-Martins, Olotuah, and Adeyemi, 2015).

2.5 Lessons from the review

Built environment is evolving with the continuum of developments at the present and those for the later time. Maintenance of public buildings is inevitable in the face of several reactive factors - especially the climate. But it should be achieved with easy and at a most economical way. Stakeholders in built environment creation, use and monitoring (professionals, larger society and the government at all tiers) have duties to also sustain it for communal welfare, safety and economic improvement through improved productivity.

Culture of the people is very important as information database, feeding Architects on how their designs might be used. It can aid design functionality when properly harness. At another time, cultural information database also provides basis for policy formulation; either to encourage and strengthen the positive aspect of the culture or to discourage its negative side altogether.

Furthermore, excellent architectural design harmonizes both cultural feedback and policy requirements to produce a functional and acceptable building. In the same vein, policy presents appropriate guide to mould culture in acceptable manner and also presents basic requirements for functional architecture.

This is in agreement with the Bell, (2004:13) which advocates thus:

“... taking architecture back to society and designing from first principles through understanding the socio-political context of society while encouraging community participation in design decision process”.

Therefore, maintenance cultural re-orientation in a top-down approach through a guiding framework would be necessary to set out for positive action. Architects as the prime professional in the built environment have to work by the integrity rule as the code stipulates to ensure holistic conception, planning, implementation and supervision of buildable and maintainable buildings.

4.0 Conclusion and Recommendations

From the foregoing, with the submission that culture changes especially through the impact of education and the possibility that built environment professionals can actually deliver professionalism, through a strong backing of the regulations, all focuses and efforts should be directed at achieving sustainable public building maintenance management in Nigeria as in other developed countries of the world.

This review hereby recommend as follows:

- Evolution and enforcement of maintenance code, regulations and policy by the government at all tiers.
- Training and re-training of built environment professionals in public service on good maintenance practice and skill acquisition through local and international workshop, conferences and field trips. Joint sponsorship of such training at 10% to 90% ratio, individual and government may be employed.
- Appointment of development consultants for government projects based on existing track records of qualitative designs, and construction supervision performance and not on who you know.
- Assignment of in-house skilled design and construction experts to supervise government project with provision of site allowance as incentives.
- Stepped-up training/education of masses to imbibe good maintenance culture through social media and other proven approaches by the National Orientation Agency. Also national recognition/reward should be given to individuals or group of people or society that conduct themselves in compliance with agreed norms.
- Certification and /or monitoring of local building material manufacturers to ensure compliance with standards. Also imported products should be certified ok by the Standard Organization of Nigeria.
- Incorporation of maintenance manual and maintenance method statement as part of statutory requirements for all government projects and other major private projects.
- Architects and Architectural firms should avail themselves of familiarity with current building materials through mandatory professional development opportunities provided in workshops and conferences like; “Archibuilt,” “Colloquium” etc.
- Issuance of ARCON/NIA practicing license to Architects upon satisfaction of minimum participation in mandatory professional development programs.

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