

Review

Review of Culture in Maintenance Management of Public Buildings in Developing Countries

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Abstract: Studies have shown that culture is one of the significant elements that influence the behavior of doing things the right way, without which there is a hindrance to the attainment of set goals. It has also been stated that culture is essential to maintaining public buildings, which is significant to national development. However, the level of abandonment and deterioration of public buildings is high due to a lack of culture among stakeholders in the maintenance process. Therefore, through a literature review from over 100 recent publications, this study measured culture as a variable that influences effective maintenance management of buildings. This was carried out to enlighten maintenance managers and policymakers within the developing countries regarding the significance of maintenance culture and possible measures for improving the attitude of stakeholders on the maintenance process. It was also carried out to develop a new maintenance focus (behavioral change) for maintenance managers and policymakers, especially in developing countries, to manage the available public buildings and other proposed ones effectively.

Keywords: behavioral change; maintenance culture; maintenance management; public buildings; stakeholders



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1. Introduction

Public buildings are building that belongs to a town, state, or organized private sector used by the public. Public buildings can also be any structure owned or leased and principally used by a governmental agency for general business, meetings, and residential purposes [1]. Like any other physical building, public buildings deteriorate at various rates [2]. As noted by Ref [1,3], the rate of its deterioration depends on the attitude of stakeholders (users and maintenance personnel) to the maintenance process and maintained buildings. Providing better maintenance management (MM) for public buildings is important [4]. However, the efficient management of public buildings is dependent on an effective maintenance process [5].

Public buildings, especially in most developing countries, are often inadequately maintained, with evidence of a lack of maintenance and repair [5]. After construction completion, most public buildings used as residential and office buildings have not seen significant care, and this has been observed to cause underutilization of the facilities [6]. The majority of these buildings are dilapidated, while others are abandoned. The lack of maintenance culture among stakeholders (Government, maintenance manager, maintenance personnel, and users) of these public buildings often lead to wastage and reduced lifespan [7]. According to Ref [8], public buildings must be effectively and efficiently managed and maintained through organizational or national maintenance policy that

addresses stakeholders' needs to achieve a good maintenance culture. Also, Ref [9] opined that maintenance operations should be innovative and strategically organized for better performance of these buildings. Maintenance stakeholders should have positive behavior developed through good maintenance culture. However, Ref [10] observed that culture endures and evolves through the learning capacity and, consequently, through sharing current knowledge with succeeding generations.

The concept of culture has been perceived differently by various studies. Ref [10] argued that culture is the key that influences the attitude of getting things done the right way, without which there is a hindrance to the attainment of goals. Ref [11] asserts that culture from a working establishment's perspective is put in place when the social relationship among members influences their pattern of thinking, behavior, and belief. On the other hand, maintenance culture is the change in the behavior, mindset, and attitude of the maintenance team towards executing the maintenance activities and operation of an organization the right way without any hindrance to the attainment of maintenance objectives of the organization [12]. Consequently, it is of essence to investigate and understand why there are divergences in maintenance management (MM) research findings. In addition, the adequacy of existing MM theoretical frameworks to be adopted in every clime is also important. This requires testing the MM frameworks developed in developed countries to ascertain if they can be adopted in developing countries. This is imperative, especially from maintenance culture within the maintenance process among the stakeholders. There is a dearth of studies on culture in maintenance, asset management, and facility management, most especially on behavioral issues relating to the maintenance process. The present study has the following objectives:

- To ascertain the relative contribution of the behavioural construct to effective MM of public buildings;
- Understanding culture in MM of public buildings;
- To assess the influence of maintenance culture on the effective MM of public buildings;
- Drawing knowledge from existing studies on methodological issues in maintenance, MM models, and challenges of MM of public buildings in developing countries.

A comprehensive literature review on the MM of public buildings was conducted to achieve this. Research works related to maintenance, MM, and maintenance models were reviewed and analysed comprehensively. The gaps were also identified and discussed. Thus, this paper makes a modest contribution to discussing behavioural issues as a new construct in understanding culture in the MM of public buildings. The study is also important to the MM of public buildings in developing countries toward achieving a more effective MM system.

2. Methodology

It is essential to verify if the existing MM theoretical frameworks proposed by studies in climes of advanced nations differ by presenting gaps that do not capture the peculiarities of the cultural context of developing countries. This is conducted with a direct and deliberate focus on the behavioral construct for MM. Maintenance culture has been included in this present study amid other factors that have already been researched. Thus, it is necessary to understand how an effective MM can be attained and the likely barriers to its attainment in the MM of public buildings. Based on this knowledge, this study adopts a literature review method. This was achieved by efficiently reviewing peer-review journal articles related to MM of public buildings. Journal articles in the asset and facility management industry were initially searched for and selected.

As shown in Figure 1, the search and selection process of the articles comprised two stages. Stage one involved the determination of academic databases. Seven academic databases, namely, Scopus, IOP, Taylor and Francis, Engineering Village, Web of Science, Science Direct, and ASCE Library, were selected for literature search due to their inclusive coverage of quality peer-reviewed journals in the research field of the construction industry most especially in the management of buildings. Stage two is where the literature search

process was conducted by inputting the following keywords: (“maintenance” or maintenance management” or “maintenance culture” or “building management” or “maintenance concept” or “maintenance approach”) and (“behavioural change” or “stakeholder needs”). The keywords are employed to search in the aforementioned seven academic databases, while the retrieved literature was restricted to journal articles written in English. There were 420 articles initially identified in the preliminary search. However, three hundred and one (301) patents and other invalid articles were removed due to overlapping literature coverage on MM among the seven databases.

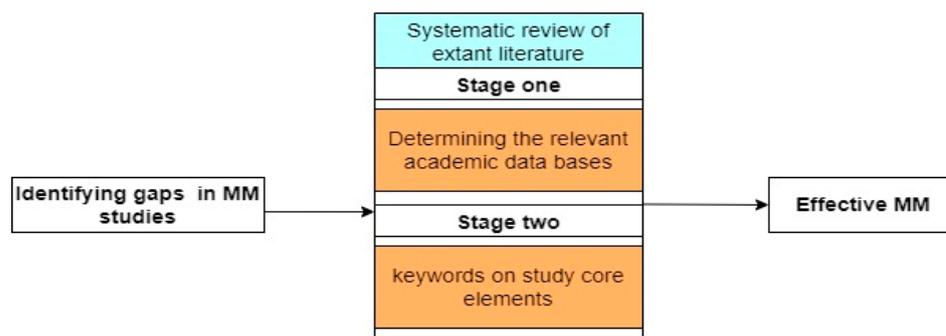


Figure 1. Research methodology adopted for the systematic review.

Consequently, 117 articles directly related to the study were retrieved for further analysis. These 117 articles provide a representative sampling of existing studies on the maintenance management of buildings. The highlight of the systematic review shows the significance of culture in the MM process toward improving the behavior of maintenance personnel and users of maintained public buildings and other assets. The study was limited to the identified databases as they provided sufficient published manuscripts, which were adopted for this study. Also, the study was limited to public buildings to give a context to the approach of maintenance culture in public infrastructure.

3. Maintenance Management Concept

Deterioration and decay of the fabric and the services begin the moment a building is completed and occupied. Hence, there is a requirement to undertake maintenance activities to ensure that the facility performs to an acceptable level [13]. As defined by Ref [14], maintenance is the combination of all technical, management, and administrative engagements during the life cycle to restore or retain it to a state in which it can perform the required function. Ref [15] defined it as the services provided for a structure (building) after completion to replace it to a standard that will make its components stable and serve its required functions without upsetting its functional ability and basic features throughout its entire life span. Ref [16] postulated that maintenance is related to redecoration, repairs, and replacement of a structure and its auxiliary facilities. This is to prevent damage and injuries and increase the economic life’s usefulness of the structure while improving its functionality and aesthetics [17]. These definitions show that the essence of maintenance in a building is to meet its required functional performance and the expectation of the users [18]. Thus, maintenance is not just to rectify defects but also to prevent them [19]. However, for the effectiveness of the maintenance process, there is a need to incorporate management concepts into it to facilitate how maintenance is carried out in buildings.

Ref [20] submitted that for MM organizations to sustain their competitiveness, they need to create a value-based maintenance system better than their rivals in the maintenance industry. Ref [21] noticed that maintenance organizations could only have an operational edge over their competitors when deploying a more effective management style to offer superior services to users. Ref [21] postulated that formulating maintenance policies and plans within an organization develops a good management strategy for effective maintenance operations. Ref [22] asserted further that resource management such as humans,

components, and materials need to be given good consideration in developing a viable MM team. Ref [23] stated that maintenance operation under viable human resources management would bring together a range of stakeholders' functions to benefit employees and the organization. Hence, Ref [21] submitted that MM of buildings is more proficient when suitability and efficient human resources support maintenance personnel toward effective MM through the best combination of cost, efficiency, and quality of the organization. Ref [24] maintain that MM is not about keeping the buildings only; it involves the management of the organization's resources and the processes it supports, operating within the realm of available resources based on the organization's corporate culture. Ref [25] affirmed that no matter how well-focused an organization might be on its core business, it cannot ignore maintenance issues, especially during maintenance operations.

4. Methodological Issues in the Study of Maintenance Management

Available literature has suggested diverse ways of measuring MM at the organization, industry, and national levels. Also, existing literature informs that there is no generic measurement of MM as the variables of MM have varied according to definitions and concepts as developed by different studies [26–29]. Ref [26,30] measured MMs outcomes using an organization maintenance strategy. Some of the strategic measures that have been used in alignment with the company's business plans include reliability, overall equipment effectiveness, number of maintenance interventions, safety/risk, logistics, and output quality, among others. On the other hand, studies Ref [31] measured MM by productivity measures. Generally, maintenance productivity measures describe the organization-specific need required to attain transparency and uniformity amongst stakeholders, including all employees of the organization. According to Ref [32], it ensures the reduction of overall productivity costs (efficiency). Additionally, it also generates activities and processes that support these objectives. Ref [31] noted that there is a need to consider value created by the maintenance process, resources allocations revising, health safety, and environmental (HSE) issues in measuring maintenance productivity. While management of knowledge, adopting a new operating and maintenance strategy, and changes in organizational management and structure were also significant.

Another point of note with studies on MM is that a considerable number of these measured MM through maintenance re-engineering measures. According to Ref [29], the basic concept of measuring maintenance re-engineering is the continuous improvement of the MM process. Moreover, the maintenance re-engineering measures consider strategies for asset and human resources, monitoring and control of individual assets, maintenance performance measurement system, planning and scheduling of maintenance activities, maintenance tactics, and application of TPM and RCM for continuous improvement [33]. In measuring the maintenance re-engineering, the MM is incorporated with knowledge, intelligence, and analysis, which support maintenance decision-making for the continuous improvement of the MM process [32]. Additionally, studies also measured MM through maintenance performance measures. Accordingly, Ref [34] posited that maintenance performance measures could be viewed along three dimensions these are effectiveness (users' satisfaction), efficiency (resources optimization), and changeability (strategic plan to handle organization changes). Ref [35] states that maintenance performance measures are concerned with the multidisciplinary process of justifying and measuring values through maintenance investment and meeting the organization's stakeholders' requirements based on overall business perceptions. Nonetheless, various issues considered in maintenance performance measures include equipment history, information system, management training, labor productivity, engineering, condition monitoring, work measurement, and incentives [36].

Also, some other studies Ref [37,38] measure MM through value-driven maintenance (VDM) measures. According to Ref [37], the philosophy behind VDM is to understand a delicate balance between the values that improved reliability can bring on the cost of maintenance. More so, Ref [38] asserted that the philosophy behind VDM measures

is the alignment of building performance with the organization's corporate strategy and maintenance resources with users' satisfaction. Additionally, VDM measures ensure holistic consideration of MM processes, procedures, practices, and implementation [39]. However, various issues in VDM measures are based on the methodology developed on four value drivers in the maintenance process: resource allocation, asset utilization, cost control, and healthy, safety, and environment [37]. The significance of VDM measures is for optimizing the value derived from the maintenance process at any point in time [37]. As informed by the literature review, there is no generic measurement of MM as the variables of MM have varied according to definitions and concepts as developed by studies. Thus, the next section reviews and discusses previous MM models and theoretical frameworks that inform effective MM systems.

5. Conceptualization of the Maintenance Management Models

Several professionals and studies have defined MM based on how they understand its concept. This, in turn, has influenced the characteristics of the attributes which impacted or determined MM in their respective studies. Among the relative nature of MM is that professionals and scholars use different words to describe similar MM concepts [31,39]. The concepts of MM as described by authors with different terms include maintenance models, maintenance systems; maintenance strategies; maintenance philosophies; maintenance types; maintenance methods, and maintenance techniques. Most literature often describes MM models on the same notion as maintenance studies [29,31,39]. Nevertheless, the variables that determine MM differ from one organization to another and from one nation to another owing to the relative nature of MM studies [27,28]. Although, in most studies, MM is well measured in relation to a particular organization in a specific nation within which the maintenance organization or agency operates [22].

The relative nature of variables that determine MM models changes with time as it shifts from one maintenance set objectives to another within an organization, industry, or nation. This is primarily due to changes in operation strategy, economic positions, changes in management, or gaps observed in existing maintenance concepts [40]. As shown in Table 1, choosing each model from existing concepts for this study is based on their philosophy supported by its specific details. As a conceptual structure, each of the models selected contained various processes (tasks/activities) that can be organized, coordinated, monitored, and managed systematically toward satisfactory completion of maintenance work not only for the maintenance administrators but for users and clients of the building (public) maintained. The different MM models reviewed from extant literature are discussed further (See Table 1).

Table 1. Summary of the core elements from the models reviewed.

Authors	Maintenance Management Core-Elements								
	Organisational Maintenance Policy	Human Resources Management	Monitoring & Supervision	Maintenance strategy	Maintenance Budget	Education & Training	Continuous Improvement	Maintenance Information System	Maintenance Culture
Ref [22]	✓	✓	✓		✓		✓		
Ref [41]	✓	✓		✓	✓			✓	
Ref [42]	✓			✓	✓	✓	✓	✓	
Ref [43]	✓	✓	✓		✓	✓			✓
Ref [44]	✓	✓	✓	✓	✓	✓	✓		✓
Ref [45]	✓		✓	✓		✓	✓		✓
Ref [46]	✓	✓	✓		✓				✓

Source: Author's compilation (2022) as reviewed from the literature.

As presented by Ref [22], the generic MM model suggests the alignment of the MM process with the three levels of business activities: strategic, tactical, and operational. The model is backed by three fundamental pillars of information technology (IT), maintenance, and organizational techniques. The models show that the process will require a maintenance plan and task scheduling at the tactical level. At the operational level, emphasis is more on maintenance tasks executed by the skilled maintenance technician based on

scheduled time, correct procedure, and proper tool usage [22]. The strategy-level maintenance information system will be required to document maintenance activities carried out. More so, at the strategy level, data will be necessary to report maintenance activities in the information system [22]. While the data provided through the computer maintenance management system (CMMS) will be transformed into information that would be used to make decisions at the levels of the business activities and prioritize actions [22]. This will allow effective control of assets and proper monitoring and supervision of maintenance processes and operations. The framework identified a set of key techniques that constitute the maintenance technique pillar: reliability-centered maintenance (RCM), total production maintenance (TPM), quantitative tools, and tactical activity-oriented stochastic tools [22].

Ref [41] suggest a maintenance model that contains three simple building blocks. The first block places the MM into the broader business perspective: finance, marketing, and operation. The second block in this MM decision-making level is planning and control, the core element with sub-variables that includes maintenance manager decisions on business functions, performance reporting, and resource management. The importance of training was highlighted to improve the maintenance personnel's knowledge for them to operate in a safe environment [41]. The last block was the third block in this maintenance framework is called the MM toolkit, which is the core element. It consists of statistics that focus on optimizing maintenance resources management. The model posits that effective MM depends on resources, task planning control and scheduling, maintenance information system, and maintenance budget [41].

Moreover, Ref [42] suggests a generic MM model. The proposed framework contains eight blocks in sequence, covering four functions representing the core element, including effectiveness, efficiency, assessment, and continuous improvement. The effectiveness of the framework covers maintenance objectives. It is related to key performance indicators, appropriate maintenance strategy specified, where assets will be prioritized, and a weak point with high impact will be acted upon [42]. The efficiency in the model shows the optimization and design of preventive maintenance plans that include resources schedule and resources [42]. Assessment in the model focuses on maintenance control, execution, monitoring and supervision, replacement optimization, and asset life cycle analysis. Whereas improvement in the model focuses on issues relating to continuous improvement by integrating new techniques where applicable [42]. The framework, however, highlighted the significance of incorporating new techniques and engineering tools with management concepts [42].

Similarly, the management process model for maintenance was developed by [43]. The model suggested that a maintenance structure include two management processes [43]. The two management processes include analysis of process effectiveness and process efficiency. The model postulated that an effective management process seeks to identify the most critical problems in maintenance activities and identify their potential solutions [43]. The efficiency management process focuses on identifying suitable procedures for maintenance operations. The model identified eight stages loops for evaluating the MM process towards achieving effectiveness and efficiency. The model specifies that the first stage determines the maintenance structure's current performance, including planning, supervision, and monitoring [43]. As identified by the model, the second stage is to analyze the quality and downtime problems achieved through policy deployment and organization [43]. However, the third stage of the model shows that there should be an adequate analysis of a potential solution to maintenance problems through continuous improvement [43]. The model postulated further that there should be an efficient analysis of maintenance procedures which can be achieved through a suitable maintenance approach [43]. The model also identified plan and execution as a stage required for evaluating the MM process, which can be achieved through planning and scheduling. Stage six, seven, and eight of the models emphasize the importance of data collection and implementation actions, data processing, monitoring and supervision, and effective information handling procedure [43]. The model

clearly shows that all this can be achieved through CMMS, which can be used for proper information gathering, process, and sharing to achieve effective and efficient MM [43].

Additionally, Ref [44] suggests a generic framework for integrating the MM for built and in-use assets. According to the framework for MM effective and efficient, there is a need for five sequential management asset maintenance plans. This model states that maintenance operations management should be based on effective monitoring and supervision for effective and efficient maintenance management [44]. However, the model shows a need to define the required maintenance objectives and develop maintenance information systems and effective maintenance operations [44]. The model also recognized a value-driven management system as vital for an effective MM system [44].

Also, Ref [45] proposes a formal structure model for effective MM. The model starts by identifying maintenance strategies for the asset and associated human resources-related aspects required to produce the needed working culture [45]. The model shows further that the organization gains monitory and control to ensure the functionality of each asset throughout its life cycle. As stated in the model, this can be achieved by implementing a CMMS, a maintenance function measurement system, and planning and scheduling the maintenance activities [45]. The model posits that depending on the value assets represent for the organization, it is accomplished according to various tactics employed on one or more of the following eight tactics: redundancy; run to failure; scheduled overhaul; scheduled replacement; ad-hoc maintenance; preventive maintenance (use-based or either age-based); condition-based maintenance; and redesign if necessary [45]. The model suggests using two highly successful maintenance methods, TPM and RCM, to realize continuous improvement. The model signifies process re-engineering techniques to sustain improvements already achieved at the top level of the maintenance process [45].

Moreover, as Ref [46] suggested, the maintenance model shows that a preventive maintenance program should be in place before advancing to the next level of maintenance activities. The model posits further that before one considers the implementation of RCM and predictive maintenance programs, there should be CMMS implementation with a suitable work order release system, provision of spare parts, and training of maintenance personnel (maintenance resources management system) [46]. The model states further that there is a need to implement total productive maintenance (TPM). The TPM would help guide the necessary maintenance organization structure configuring and applying statistical tools for financial optimization [46]. However, the model signified continuous improvement in maintenance practices to achieve an effective maintenance management system.

Table 1 summarizes the core elements identified from the MM models reviewed above. It showed that all of the models reviewed have core elements such as organizational maintenance policy, human resources management, monitoring and supervision, maintenance strategy, education and training, continuous improvement, and maintenance information system, as indicated by the mark symbol (\checkmark) in Table 1. Also, they have been used by studies such as Ref [29,47,48], among others, to develop different maintenance concepts for effective MM of buildings. However, as indicated further in Table 1, maintenance culture focusing on behavioral issues is an element that has not been addressed by any of the maintenance models analyzed. This clearly shows that maintenance culture as a construct in some existing literature and concepts for effective MM of buildings has been marginalized [49]. According to Ref [49], this might have been why huge and costly projects go into disuse in a short while. Ref [49] emphasized that a culture-based MM system of buildings ensures regular servicing, repairs, and maintenance of working assets or established procedures to guarantee their continuous usefulness. Ref [49] also observed that the inculcation of culture in the maintenance process or concepts could increase the quality of maintenance activities. Ref [50] also posited that maintenance culture is unique for each organization. Therefore, it is important to understand culture as a construct in the MM process, especially in understanding the behavioral aspect of the stakeholders (maintenance personnel and users) of the public buildings.

6. Culture in the Context of Maintenance Management Study

Public buildings are developed to fulfill society and organizations' needs. Ref of [12] postulated that public buildings are critical to an organization or nation's resources. Ref [7] observed that the present maintenance problem in public buildings had become an important agenda for developing countries and pressured their government to manage their public buildings. Ref [51] sustain that public assets, especially public buildings, are not maintained properly due to the nonexistence of a maintenance culture. Hence, developing a maintenance culture based on stakeholders' behavior, environmental needs, values, and cultural beliefs is essential [51].

In this study, maintenance culture is defined as the perception, behavior, value, and underlying norms of a person, group, or society that considers maintenance as a matter that is a priority and practices it in their daily life cycle. Maintenance culture in maintaining public buildings is not easy to develop. It takes time, and it can mostly occur in response to individual (stakeholders) attitudes to changes. Thus, a person, society, or country with a maintenance culture would have a good attitude toward regularly maintaining, protecting, and preserving public buildings. The attitude in this context is the behavior of stakeholders in responding to maintenance work, needs, or damaged components within the building maintained. According to Ref [52], maintenance culture is not universal but can be emulated, derived, or learned by others, making maintenance a natural daily practice. The studies of Ref [53–55] showed that the cultural aspect that is the basis of a maintenance process and operation is often overlooked. Ref [56] stated that the absence of maintenance culture due to behavior issues among stakeholders has led to an increase in management and maintenance costs to repair damaged buildings and their auxiliary facilities. Ref [12] observed further that maintenance problems could be better solved through the behavior change of individuals in the maintenance process of buildings. Ref [53] state that behavior change is essential to improve maintenance work's tenancy, skills, and diligence. Ref [57] observed that a maintenance culture is not easy to develop. This is due to the fact that keeping up a good maintenance culture takes time and occurs in response to changes in the individual [58].

For societies to exist, there must be a cultural exhibition [59]. The fluid operation of society is supported by cultural norms and cultural values that guide people in making choices [59]. However, Ref [60,61] opined that the culture of maintaining and sustaining infrastructures is essential to national development. Ref [61–63] posit that the absence of maintenance culture, especially in the public sector of most developing countries, has been the bane of an infrastructure-driven national development. Ref [64] observed that the development of maintenance culture is one of the significant forces that catalyze the growth of any nation's economic, social, and technological advancement. It has been noted that a paucity of maintenance culture characterizes the MM of public buildings in most developing countries, especially among stakeholders of buildings maintained [56,63]. However, past studies have reiterated the importance of maintenance culture among stakeholders in the MM of public buildings in developing countries [2].

However, studies have differed in views about the specific variables that constitute the determining factors in the development of maintenance culture in the management of buildings. Ref [12] identified effective communication in the MM system; reward systems and recognition; empowerment; motivation; involvement; strategy and work planning; teamwork, good policy system, training and education, and organizational cultures as determining factors in developing a culture-based maintenance model. Nevertheless, there are still challenges in developing culture-based maintenance systems in developing countries [22,65].

6.1. Cultural Challenges in Maintenance Management of Public Buildings in Developing Countries

According to Ref [66], the development of maintenance culture is one of the major forces that catalyze the growth of any nation's economic, social, and technological advance-

ment. Ref [67] postulated that the deterioration level of public buildings in most developing countries poses a great concern for national prosperity and a healthy environment. Ref [66] noted that challenges facing the developing countries' ineffective maintenance culture of their public buildings could be attributed to lack of maintenance policy, lack of professional maintenance practice and ethics, and corruption in the maintenance process. Ref [67] also identified a lack of on-job training, lack of awareness of the importance of maintenance, and usage information on maintained buildings. On the other hand, [63] identified variables such as corruption, leadership challenge; behavioral issues; lack of policy as factors that cause no maintenance culture within an organization.

Existing literature such as Ref [56,68,69] indicated that developing countries lack cultural behavior that ensures effective and efficient functioning of the public buildings and fosters national development. Moreover, provision for adequate care of the hard-earned infrastructure has not gained ground in the consciousness of stakeholders in the country over the years. This is due to the absence of a maintenance culture. For instance, Ref [56] observed that poor maintenance culture had become a widely acknowledged problem in Nigeria. This has made the country prioritize property management and maintenance activities [70]. Ref [71] affirmed that Nigeria has no functional maintenance policy and, therefore, is a dearth of culture toward the maintenance process and the maintained public buildings. Ref [72] indicated that inadequate maintenance culture is peculiar in almost every public building in Nigeria. As posited by Ref [73], this is partly due to the problem of maintenance culture based on societal behavior toward the maintenance process and the maintained buildings. Ref [72] postulated that the leading factors to Nigeria's ineffective MM of public buildings are the declining maintenance culture, corruption in the maintenance process, and lack of political will. Similarly, Ref [69] showed that warranted attention had not been given to maintaining public buildings in Ghana. This has restricted Ghana's development through gaping infrastructural deficit and poor maintenance culture of existing public buildings. This was bolstered by Ref [74] that Ghana continues to invest heavily in new public facilities while the sustainability of the existing ones suffers from poor maintenance culture. Ref [75] opined that Ghanaians have a growing awareness about the lack of maintenance culture in public buildings. Ref [75] stated further that Ghanaians' attitude to public-owned buildings is generally negative, with the common understanding that it is "nobody's property." The study of Ref [76] stated clearly that in Ghana, most of the public buildings accommodating public servants had not seen any significant maintenance since they were constructed. Ref [74] postulated that owing to a lack of maintenance culture, the maintenance of public buildings is awful in Ghana.

In Kenya, Ref [66] observed that public building maintenance had not received much attention since more emphasis was on developing new buildings. Ref [66] further posited that due to non-maintenance culture, a crisis is looming in the building stocks. This is due to the fact that existing private buildings and other public infrastructure are running down and losing their utility value due to a lack of maintenance culture. Moreover, Ref [66] opined that the maintenance policy in Kenya, based on borrowed cultures from the firmly grounded maintenance culture of developed countries, has proven to be environmentally unfit for MM activities in Kenya. Similar problems of maintenance culture are evident in other parts of Africa, as acknowledged in South Africa. Ref [77] study showed that the maintenance problem concerning government buildings in South Africa is not unique. Ref [78] observed that due to several structural factors such as lack of MM culture, maintenance of public buildings could not be adequately addressed. Ref [79] finding on MM of public facilities in South Africa shows that the maintenance of buildings is mainly based on developed countries' maintenance systems. Ref [80] postulated that the inability to meet industry and consumer demands on basic building services is due to ageing caused by the lack of maintenance culture of management of existing buildings. This assertion was buttressed by Ref [81] that since 2005, maintenance of most public buildings has been held up due mainly to a lack of proper maintenance plan and culture. Furthermore, Ref [82] observed little funds were assigned to maintaining existing public buildings while new projects were

fully funded. Due to many years of maintenance neglect and the dearth of maintenance culture, existing public buildings are deteriorating. Also, a study carried out by Ref [83] on financing infrastructure maintenance in South Africa concluded that due to years of sub-standard maintenance, majorly due to a lack of maintenance culture, the quality and reliability of most public buildings remain poor.

Thus, in addressing the culture gap in MM of public buildings in developing countries, mainly the behavioral change management theory was engaged in holistically addressing the knowledge gap. The theory covers a broad scope of thought and appears close to containing all of the essential vital skills required for effective management through increased employee loyalty to the organization. It provides a job for life with a strong focus on the well-being of stakeholders that can influence their attitude toward the maintenance process and the maintained buildings.

6.2. Behavioural Change Management Theory

As described by [84], change is the crystallization of new possibilities such as new behavior, policies, methodologies, patterns, products, or market ideas based on institutions' re-conceptualized patterns. Ref [85] summarily describes the change as a simple process. Change is about travelling from the old to the new, leaving yesterday behind for the new tomorrow. Nonetheless, implementing change is incredibly difficult. Most people are reluctant to leave the familiar behind. We are all suspicious about the unfamiliar; we are naturally concerned about how we get from the old to the new, especially if it involves learning something new and risking failure or changing our behavior toward achieving a new ideal. Thus, Ref [86,87] postulated that change management is the organizational movement from the existing plateau toward a desired future state to increase organizational efficiency and effectiveness.

Change management can involve technological developments; transformational relationships, organizational control; organizational structure; organizational culture; organizational locations; balance sheets, and others [88]. Ref [89] stated that change within the organization depends on the degree and nature of transformation within the organization. Therefore, an organization needs to strive to change individuals' rites, rituals, behavior, and values in organizations [90]. However, managing and implementing change can be ambiguous [2,3,90]. Additionally, change management ensures that organizational goals are met properly using organization resources.

From the above literature, it can be deduced that to maintain an effective MM of public buildings, changes, especially behavioral change, are a way of life that the stakeholders must embrace. Conversely, change management in maintenance organizations aim to ensure that the set goals are achieved by effectively managing maintenance personnel and other stakeholders. By better understanding their rites, rituals, behavior, and values within the maintenance organization. This will help the maintenance organization gain a competitive edge over its rivals and meet the needs and expectations of the users of their facility. To better understand the change in the maintenance process, Kotter's change model is discussed below in understanding maintenance culture within an organization.

6.3. Kotter's Model of Change

Kotter's change model explained that changes are a continuous adaptation process to changing conditions and circumstances. The model approach to change also shows that change should be perceived as a continuous, open-ended adaptation process to changing circumstances and situations [91]. Approaches to this model show that maintenance personnel need to be continuously trained and educated not only on their job but also on innovation, technology, techniques, material selection, job behaviors, and values. Also, the model showed that the maintenance organization should develop a maintenance strategy that will create a benchmark for stakeholders required for both the maintenance process and usage of maintained buildings. In achieving the set maintenance goals of an organization, the model advocates eight steps in the change process. The steps in Kotter's

model change concerning culture as a variable for effective maintenance management are further described in Table 2.

Table 2. Change concerning culture as a variable for effective MM of buildings using Kotter’s 8-step model.

Levels	Kotter’s 8-Step Model of Change	Impact in Relation to Effective Maintenance Management Process
Level 1	Increase Urgency	Identify maintenance needs through an early warning system
Level 2	Build Guiding Team	Assembly of the effective maintenance management team
Level 3	Develop the Vision	Set maintenance objectives, development of maintenance policy
Level 4	Communication for Buy-in	Developed the maintenance plan, strategy required and involved the stakeholders.
Level 5	Empower Action	Education and training of maintenance personnel
Level 6	Create Short Term wins	Establishment of benchmark for maintenance operations in terms of quality
Level 7	Don’t let up	Consolidate on improvement through continuous improvement
Level 8	Make Change Stick	Institutionalised the new maintenance approach.

7. Implication of the Study

The focus for maintenance organizations is to capture the organization’s past, present, and future performance in meeting the organization’s maintenance business plans, maintenance objectives, equipment prioritization, cost/benefit analysis, and users’ requirements, among others [1,4,6]. Summarily, the main stimulus for undertaking maintenance is to deter deterioration and abandonment in the building maintained [9,15]. The focus on managing the maintenance process and operation is the difficulty experienced in addressing stakeholders’ behaviors toward the maintenance process and the preserved buildings [24,29]. Nonetheless, considering the exclusive role of stakeholders of the maintained public buildings, understanding their needs, and the ability to manage any new changes towards improving their behavior within an organization would lead to an effective MM system [53–55]. Conversely, in the behavior of stakeholders in the maintenance process and activities, including usage of the maintained public buildings, there is a likelihood to change when a discontinuity occurs in the management of established rules guiding the direction of the stakeholder’s commitment and attitude [53–57].

Therefore, an effective change management system is the key opportunity of involving stakeholders in any changes that might occur in the MM process of buildings to make them change their behavior toward meeting maintenance goals [86–90].

Additionally, previous studies Ref [12,53,57,60] have shown that understanding stakeholders’ needs, continuous improvement, and maintenance strategy development are key elements for formulating MM policy for specific industries, organizations, or nations.

Thus, as shown in Figure 2, in developing an effective MM policy, models, or concepts for public buildings in developing countries, the behaviour of stakeholders (maintenance culture) should be matched and considered in designing different maintenance instruments. This will help in improving and addressing the following:

- The crisis of maintenance of public buildings stocks through improved attitude toward maintenance process;
- It will trigger new thinking (political and administrative thinking) in maintenance policy formation;
- Enormous improvement in maintenance performance;
- Improving a healthy living environment with proper social values;
- Reduction in the total maintenance budget of buildings;
- Cautions and continuous adherence to maintenance guidance and regulation;
- Issue of preservation of aesthetics and qualities of maintained public buildings;
- Necessary safety and improve the sanitary level;
- The commitment of stakeholders to the maintenance process and maintaining public buildings.



Figure 2. Culture-based maintenance management concept for public buildings.

The study’s findings indicate that maintenance focus must be shifted from strategy to behavioural issues (See Figure 3). This is due to the fact that all of the important maintenance strategy attributes such as policy, budget, training, maintenance information system, and others required for effective MM were present in nearly all of the existing maintenance concepts or models. While the problems of deterioration and abandonment still exist in the maintenance management of public buildings. This problem, as observed, is due mainly to the absence of maintenance culture and behavioural change among stakeholders of buildings being maintained. Nevertheless, there is a need to change behaviour, attitude, and mindsets towards maintained building through its usage or maintenance process and operations.

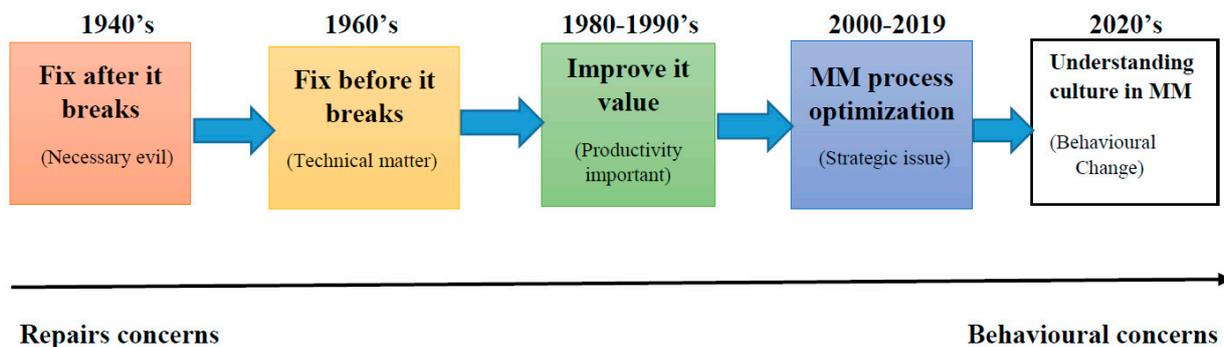


Figure 3. Changing maintenance management focus.

8. Concluding Remarks and Recommendation

The continued deterioration and high decay of public buildings in developing countries are of great concern. This has drawn the attention of policymakers, academics, and other stakeholders involved in these buildings’ policymaking, usage, and maintenance. Also, the desperate need to investigate culture-based MM of public buildings is linked to evidence revealing an improved level of building users’ well-being, performance, productivity, and health benefits associated with an adequate and effective preventive MM system. This study presents a comprehensive overview of MM studies by focusing on behavioral issues affecting the development of culture-based MM in public buildings. This study provides important information to policymakers, academicians, and maintenance managers on

developing a MM system guided by specific issues that can change stakeholders' behavior in the maintenance process and usage of the maintained public buildings. The research finding shows that change in behavior of stakeholders regarding the maintenance process and the maintained public buildings will lead to the following:

- Reduction in the level of deterioration, decay, and abandonment within the public buildings;
- A benchmark for the maintenance process and usage of the public buildings;
- An early warning system for identifying damaged components of the public buildings;
- Use of quality replacement materials for the maintained public buildings;
- Resource wastage and its associated cost and time overrun will be averted in the maintenance process of public buildings.

Based on the literature review, this study concludes that understanding the culture in MM of buildings within developing countries should be centred on behavioural change, especially on the usage and maintenance process of public buildings maintained. This will immensely help developing countries to establish a cultured maintenance system. Also, it will lead to the continuous improvement of the maintenance process toward the development of an effective MM system. The study thus recommends that for a better understanding of the culture in the MM of public buildings in developing countries, the maintenance organisations should be guided by the following:

- There is a need for behavioural change toward the usage of the maintained public buildings;
- Rightful skills should be used for maintenance operations with the public buildings;
- Required tools and environment should be created for an effective maintenance process;
- Effective communication should be developed among stakeholders;
- There is a need to provide a benchmark for maintenance operations;
- There is a need to ensure early servicing and repairs for damaged building components;
- User maintenance guide should be provided within the maintained buildings;
- A standalone maintenance policy/law should be provided for the maintenance of public buildings;
- There is a need for effective decision-making on the maintenance process and operation;
- There should be an early response to damaged components of the public buildings.

Finally, in understanding the place of culture in the maintenance management of public buildings, there is a need to motivate maintenance personnel by meeting their needs and giving recognition to their efforts to improve their behaviour toward the maintenance process. This study adopted a theoretical approach to achieving the set objectives. Hence, further studies can be carried out to apply this study's theoretical positions and findings in typical real-life situations.

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