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# Deferred maintenance of buildings: A review paper

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**Abstract.** The building must be maintained to keep it in optimal operation in giving service and it is vital and also it can be influenced towards the building performance. Therefore, immediately after construction of the building project is completed, maintenance start to set in. The conducive environment that provided for the buildings will give a good performance and significant impact. Therefore, building maintenance is crucial in making sure the buildings can deliver a good service or function, but in certain reason building maintenance and repair activities that were not performed when they should have been will be deferred. Deferred maintenance occurs because there is no efficiency in managing building maintenance. Deferred maintenance has become a pressing issue in many countries and have adverse effects to the organization (stakeholders and users). Hence, this study is intended to provide definitions, issues and challenges of deferred maintenance of the buildings.

## 1. Background

Nowadays, it's become a great challenge to ensure that all the building's condition and quality are at the top so that their serviceability could be maintained and can fulfil their function requirements [1]. Generally, once buildings have been completed they expected to perform on function in certain period of time. Proper maintenance of the buildings is important and need to be given a priority by the organization [2]. Thus, a building must be maintained to keep it in optimal operation in giving service and it is vital and also it can be influence towards the building performance [3]. [3] also mentioned, building maintenance and building safety are closely related to each other. Therefore, there are a need to create a conducive environment that support all activities in the buildings. Thus maintenance is crucial in making sure the buildings can deliver a good service or functional. In Malaysia maintenance of buildings were not different from other facilities which are preventive, corrective and condition based but currently most of the building rely heavily on corrective maintenance [3]. Hence, can be said that organizations in Malaysia are still managing their buildings in the traditional ways [4].



## 2. Introduction

Building construction is a human activity that existed a long time ago [5] and is one of the biggest industries in the world today [6] and building maintenance is one part of it that need to be carried out after the completion of the building. Buildings require maintenance in order to create a conducive environment and meet the physical needs that supports and stimulates the activities. Therefore to meet the purpose and keep the buildings usable [7], there are a need to make sure all the buildings are working in a good performance condition [8]. With this conducive environment that provided to the buildings will give a good performance and significant impact. Hence, in order to optimise the users it should never be exposed to the risks [9]. Nowadays, [10] points out that one of the major problems for the countries is inadequate maintenance. According to [11], more than 90% of the life cycle of building required maintenance after completion of construction and 75% approx. of the total expenditure on life cycle cost of building is due to maintenance. Hence, this proves that repair and maintenance is a critical element in organization and expected work will become more important and will be increased in the future and it carries dire consequences if ignored. Top management and maintenance organisation are aware of the physical appearance of their respective buildings, installed systems and services within the buildings appear to be deteriorating.

## 3. Definition of building maintenance

Building maintenance is defined as the preservation of a building so that it can serve its intended purpose [12]. In addition, [13] state that British Standard 3811 (1984), has defined building maintenance as a combination of any actions carried out to retain an item in, or restore it to, an acceptable condition. In placing more emphasis, [14] mentioned that The Chartered Institute of Building, CIOB (1990) defined maintenance as work undertaken in order to keep, restore, or improve every facility i.e. every part of a building, its services and surrounds, to an agreed standard determined by the balance between the need and the available resources. For some people, building maintenance is a complex process and involves large financial resources but if implemented efficiently, it can save money other than the potential for building life. It is practically impossible to produce buildings which are maintenance free [15]. Therefore, immediately when construction of buildings project are completed, maintenance start to set in. Building maintenance assist a lot in retaining the economic value of building and also to extend the building's lifespan The maintenance of the building should be taken into account and carried out during the phase which follows the construction phase until the operational phase [16].

## 4. Definition of deferred maintenance

Basically the term of deferred maintenance is repair work that have been postponed to a future date beyond the recommended service [17]. Deferred maintenance refers to maintenance and repair activities that were not performed when they should have been. The repair and deficiencies that are unfunded, unavailability of sufficient funds and human resources [18] and any kind of reason or issues at the fiscal year on a planned or unplanned basis and are deferred or postponed to a future fiscal year until the issues are solved. Deferring maintenance work can reduce the overall life of facilities and may lead to higher costs in the long term [19]. Basically deferred maintenance occurs because there is no efficiency in managing building maintenance. Building maintenance management practice which is not in the right practice will give the bad impact towards the building and the environment [20]. According to [21] deferred maintenance is physical depreciation, or loss in value of a building, that results from postponed maintenance to the building. This type of depreciation normally is curable by making the necessary repairs and improvements. It is sometimes called curable physical depreciation or curable obsolescence. According to [22] the deficiency in maintenance management system also makes organizations hard to totally record facilities defect periodically can contributed to deferred maintenance. In placing more emphasis, [23] mentioned that, deferred maintenance often referred to as unfunded or unaccomplished maintenance or backlog, has not been a popular or frequently discussed topic in the literature. Furthermore, in an observation based on study by [23] also opined that, there are

four basic analytic steps were identified for the full reporting of deferred maintenance:

- Assessment of the condition of the building and facilities.
- Determination of a minimum acceptable condition level for each type of buildings and facilities.
- Estimation of the cost to bring those buildings and facilities back to acceptable condition; and
- Estimation of the consequences of deferring maintenance.

## 5. Issues of deferred maintenance

Deferred maintenance have become a pressing issue in many developing countries and have adverse effects on quality service and performance of buildings, stakeholders and users. The related issue of deferred maintenance whereas organisation needs to identify factors causes and implementing programs to reduce deferred maintenance in future [14]. Reducing facilities deterioration and sustain functional facilities in support of institutional objective and mission is also a requirement. There is a challenge for organisations to keep the aesthetic value to give attraction to the buildings. With deferred maintenance the stress on organisation to hold it all together, there is a need for find a way to prioritize and achieve sustainable building agenda. In addition, [24] also opined that the issues of deferred maintenance can be summarized as:

- No linkages between strategic and operational planning in piecemeal approach for capital planning.
- Chronic in resource shortage.
- Inadequate management policies and practices as well as internal politics.
- Unrealistic financial planning.
- Misunderstood and misapplied needs assessment methodologies and tools.
- Lack of performance measures.

## 6. Challenges of deferred maintenance

Deferred maintenance is a mistake that comes from presenting part of the appropriate category of needs to improving existing physical conditions by combining the annual life cycle reforms for its buildings and systems that have reached the end of life as well as enhancement and improvement needs. According to [24], there are two (2) major challenges in addressing deferred maintenance:

- Consistent and commonly applied a definition of deferred maintenance.
- A capital planning through process identifying and integrating of all campus capital needs.
- Addressing deferred maintenance is a fundamental responsibility of the maintenance management professional. It is required to understanding of the definitions and methodology in developing reliable and convincing capital planning process.

## 7. Overview of causes of deferred maintenance

Existing studies such as [25] investigating the research of poor facility management in the Public Schools of Ghana. Empirical discoveries was used in gathering and analysing the data obtain from the research. The researcher found that several causative factors contributed to the poor facility management. However, only fifteen (15) causes direct relate to deferred maintenance. The causes are lack of funds, lack of management; lack of knowledge, lack of training; lack of planning; neglect towards importance of maintenance; lack of expertise; building age; do not have rule, standard practice, guideline and implementation mechanism of building maintenance; lack of qualified and professional maintenance/ facility managers; poor maintenance culture; attitude of deferred maintenance; low priority on maintenance financial planning and capital budgeting; difficult to maintain because of poor designs of buildings and budgetary restriction on maintenance expenditure. The researcher [26] conducted a study of maintenance management sourcing strategies and the

condition of tertiary institution buildings in Lagos and Ogun States, Nigeria. A structured questionnaire was designed and used as the principal instrument for collecting data for this study. This study found that the right chosen a strategy of maintenance sourcing procurement either insourcing (in- house) or outsourcing is capable of assisting to prevent the occurrence of deferred maintenance and consequently improved maintenance services towards well maintained buildings. Thus, in the other word the accuracy of the procurement selection will be a cause to the deferred maintenance. According to [27] attempted to assess the maintenance and rehabilitation prioritization of school buildings using Knapsack Problem. Data were gathered through a case study to apply knapsack algorithm within dynamic programming framework. The researcher addressed the main factor inhibits the quality of the buildings in their research is limited budget. This factor is related to the causes of deferred maintenance. Further, [28] was carried out a research to identify the factors militating against effective maintenance of tertiary institutions' buildings. A questionnaire and interview were carried out, 4 potential causes related to deferred maintenance were identified. The causes are lack of funds, lack of training, unavailability of skilled appointed maintenance personnel and lack of understanding of the importance of maintenance. The researcher [7] who carried out assessment of building maintenance management practice for Abubakar Tafawa Balewa University Teaching Hospital, Bauchi found that in his study by using questionnaire to gather information. There were several factors contributing greatly to the poor management practice. However, 23 causes that related to deferred maintenance are budget constraints; poor maintenance management; lack of awareness among the maintenance staff; little priority on maintenance; lack of quality and qualified maintenance manager; unqualified, ill- trained and unprofessional personnel; ineffective planning; lack of knowledge; lack of resources; administration system faults; lack of maintenance culture; lack of emphasis on training; lack of training and continuing education in efficient; absence of planned maintenance programme; complexity of design; Unstable organizational structure; poor strategies for maintaining; absence of regulations/legislations; lack of sustainable policies; political interference; lackadaisical attitude of senior management staff; lack of understanding of the importance of maintenance; and poor attitude of maintenance team.

Another researcher [11] has carried out a study on Factors for Maintenance Priority in Malaysian University. A review of literature was incorporated as a means of generating data for the research. The study conducted through literature review to provide a general guideline for the factors that are considered in setting maintenance priorities. These several factors are important and need to give attention where they can affect and become a causes of deferred maintenance. The findings discovered that the causes are lack of funds; stakeholders (policies, goal & objectives); and political interference. The researcher [3] conducted regarding interval of routine maintenance and maintenance performance: a literature review. The research by an extensive review of literature published in 1987 to 2014 is performed for the purpose of this research implementation of maintenance strategy. The results from study suggested the most important causes of deferred maintenance are ineffective planning; lack of knowledge; poor management; and neglect towards importance of maintenance. This claim can also be supported by [29] conducted a research on establishing the status of building maintenance operations of Nigerian Universities based on the European Construction Institute Total Quality Management Measurement Matrix. The questionnaire was employed in generating the data required for the research. Some of their findings revealed and indicated that in order to achieve acceptable quality management in their building maintenance practices these factors need to be improved the prosperity of organization; making work more enjoyable; need commitment to overcome resistance; training awareness, education and skills; clear policy, objective and strategies; effective planning; the existence of rules, standard and procedures; adequate resources; communications and team work for improvement; and good ethics and attitude of maintenance team. Hence, in the research of deferred maintenance, the causes are contrary to the factors of this study. However, it still contributes to the causes of deferred maintenance. Furthermore, [20] carried out a study on the development of building maintenance management best practice in Malaysia: a review. The study discovered that, there are a lot of elements that must be considered to develop the building maintenance management best

practices. Five major aspects that have become the focal points for previous scholars are strategic planning, resource management, information management, user involvement, and performance control. However, from this highlighted aspect come out a few factors that can be related to the causes of deferred maintenance. The causes are lack of funds; unrealistic financial planning and management; poor of management; ineffective planning; lack of emphasis on training; unavailability skilled of maintenance personnel; poor attitude of maintenance team; information and Communication technology; absence of regulations/ legislations/ procedure/ standard practice/ guideline/ manual; lack of commitment; lack of human resources; lack of financial control; unstable organizational structure; and poor strategies for maintaining. In observation based on study of [30] directed their research efforts towards maintenance practice for school buildings in Malaysia. A survey questionnaire identified problems was conducted in performing maintenance work of this research. Their major findings revealed that there are several causes can be related to deferred maintenance and the most causes are insufficient budget allocation for maintenance; lack of efficient management; and do not have sufficient knowledge. Another study related to deferred maintenance was carried out by [14]. Data was gathered through review of literature. The researchers concluded that maintenance which is deferred because of insufficient funding; poor of management; ineffective planning; lack of understanding of the importance of maintenance; neglect towards importance of maintenance; lack of expertise; unforeseen expenses; building age; misunderstood needs assessment methodologies and tools; lack of performance measure; lack of quality and qualified professional maintenance/ maintenance managers; lack of maintenance culture; low priority on maintenance financial planning and capital budgeting; and lack of resources. Research conducted by [31] on towards effective management of university education in Nigeria. Their study were identified inadequate funding for maintenance activities and mismanagement of the funds available as the underlying factors responsible for the decay and deferred maintenance. However, these claims also contended by [32] directed their research efforts on identifying maintenance issues in Malaysia. A literature review, with the support of interviews conducted to generate the much needed data for the study. The findings of their research uncovered the causes that can be related to the deferred maintenance are limited budget; lack of management; ineffective planning; lack of quality and qualified professional maintenance/ maintenance managers; chronic in resource shortage; poor of ethics; and ambiguous contract. The study that can be summarized from the academic literature of research on contributing causes of deferred maintenance of buildings shows in Table 1.

**Table 1.** Causes of deferred maintenance of buildings.

Causes	Wuni et al 2018	Faremi et al 2017	Thohir et al 2017	Nwacuku et al 2016	Aliyu et al 2016	Chong et al 2016	Au-Yong et al 2016	Abdulazeez et al 2015	Nah et al 2015	Ropi & Tabassi 2014	Hamid et al 2010	Ekundayo & Ajayi 2009	R. Mazalan & Mohammad 2009
Lack of funds	X		X	X	X	X			X	X	X	X	X
Poor management	X				X		X		X	X	X		X
Lack of knowledge & skills	X				X		X	X	X	X			
Lack of emphasis training	X			X	X			X	X				
Ineffective planning	X				X		X	X	X				X

Neglect towards importance of maintenance	X			X			X	
Lack of expertise	X						X	
Building age	X						X	
Do not have rule, standard & regulation	X		X		X	X		
Lack of quality & qualified	X		X	X			X	X
Poor culture	X			X			X	
Lack of ethics, Attitude & commitment				X		X		X
Low priority	X			X			X	
Poor design & budget restriction	X			X				
Procurement accuracy		X						X
Lack of understanding			X	X				
Lack of resources				X		X	X	X
Administration system faults				X				
Absence planned program				X				
Unstable organizational structure				X		X	X	
Lack of sustainable policies, objective & strategies				X	X		X	
Political interference				X	X			
Lack of communication & teamwork						X	X	

## 8. Conclusion

Addressing deferred maintenance is a fundamental responsibility of the organization professional. Required is an understanding of the definitions, issues and challenges of deferred maintenance to develop a credible and persuasive the planning process. Deferred maintenance liability requires documentation of the causal factors, and shall include the impacts need to be developed and follow by methodology and contribute to meeting the changes and challenges of an organisation. This study has made and provided a platform for addressing future research into a process protocol for deferred maintenance. This literature review set out to identify all relevant published journal articles from the past ten years (2018-2008), focusing on issue, practice, management, effective management, total quality management matrix, performance and priority of maintenance.

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