

Factors Affecting Building Maintenance Practices: Review

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ABSTRACT

Buildings begin to deteriorate gradually over time due to several factors, including environmental influences, improper use of the building, and neglected repairs for damages during the building's life span. Effective maintenance practices can minimize operational costs, extend the life of building systems and components, improve energy efficiency, and maintain property value. This paper aims to review articles related to building maintenance to identify factors affecting maintenance practices. After conducting the review, the result was that there were 33 factors affecting building maintenance categorized into six groups: management-related factors, manpower-related factors, technical-related factors, financial-related factors, building user-related factors, and building characteristics-related factors. Facility managers can enhance their understanding of building maintenance by examining the various factors that affect maintenance. By doing so, they can assess how these factors affect maintenance practices. This evaluation is crucial as it assists in creating efficient maintenance plans while optimizing resource allocation and timely repairs. Moreover, this approach enables facility managers to adopt proactive strategies toward maintenance, ultimately leading to cost savings by addressing or managing potential obstacles hindering optimal building maintenance.

Keywords: Building maintenance, Facility maintenance, Maintenance practices.

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العوامل المؤثرة على ممارسات صيانة المباني: مراجعة

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الخلاصة

تدهور المباني تدريجيًا بمرور الوقت لأسباب مختلفة ، بما في ذلك التأثيرات البيئية والاستخدام غير السليم للمبنى والإصلاحات المهملة للأضرار التي تحدث خلال عمر المبنى. من خلال إجراء ممارسات الصيانة الفعالة ، من الممكن تقليل التكاليف التشغيلية ، وإطالة عمر أنظمة ومكونات المباني ، وتحسين كفاءة الطاقة ، والحفاظ على قيمة الممتلكات. تهدف هذه الورقة إلى مراجعة المقالات المتعلقة بصيانة المباني لتحديد العوامل التي تؤثر على ممارسات الصيانة. بعد إجراء المراجعة ، كانت النتيجة أن هناك 34 عاملاً يؤثر على صيانة المباني تم تصنيفها إلى ست مجموعات: العوامل المتعلقة بالإدارة ، والعوامل المتعلقة بالقوى العاملة ، والعوامل ذات الصلة الفنية ، والعوامل المالية ، والعوامل المتعلقة بمستخدم المبنى، والعوامل المتعلقة بخصائص المبنى . يمكن لمديري المرافق فحص العوامل المختلفة التي تؤثر على الصيانة. من خلال القيام بذلك ، يمكنهم تقييم كيفية تأثير هذه العوامل على ممارسات الصيانة. هذا التقييم مهم لأنه يساعد في إنشاء خطط صيانة فعالة مع تحسين تخصيص الموارد والإصلاحات في الوقت المناسب. علاوة على ذلك ، يمكن هذا النهج لمديري المرافق من اعتماد استراتيجيات استباقية للصيانة ، مما يؤدي في النهاية إلى توفير التكاليف. وايضا معالجة أو إدارة العقبات المحتملة التي تعيق الصيانة المثلى للمباني

الكلمات المفتاحية: صيانة المباني، الصيانة، ممارسات الصيانة .

1. INTRODUCTION

The Oxford Advanced American Dictionary defines maintenance as keeping something in good condition by regularly inspecting or repairing it. In British Standards (**BS 3811, 1993**), maintenance combines all technical and administrative actions, including supervision actions, intended to retain or restore an item to a state where it can perform a required function. Two processes are envisaged: "to keep," which is the work carried out in anticipation of failure, usually referred to as preventive maintenance, and "to restore," which is the work undertaken after the failure has occurred, referred to as corrective maintenance. (**Alzubaidi, 1993**). Maintenance types are divided into planned and unplanned categories (**Chanter and Swallow, 2008**), as shown in **Fig. 1**.

A- Planned maintenance: the organization performing maintenance with planning, supervision, and the use of records to adhere to a predetermined plan (BS:3811). There are two types:

- B-** 1-Planned preventive maintenance: To ensure a facility's continued operation, preventative work is performed throughout its projected life span (**Seeley, 1976**).
- 2-Planned corrective maintenance: the work done to get a facility back in working order or to a certain standard. (**Seeley, 1976**)

C- Unplanned maintenance: the maintenance carried out with no predetermined plan (BS:3811, 1993) has one form. Unplanned corrective maintenance: work brought on by unanticipated failures or damage from outside influences (Seeley, 1976).

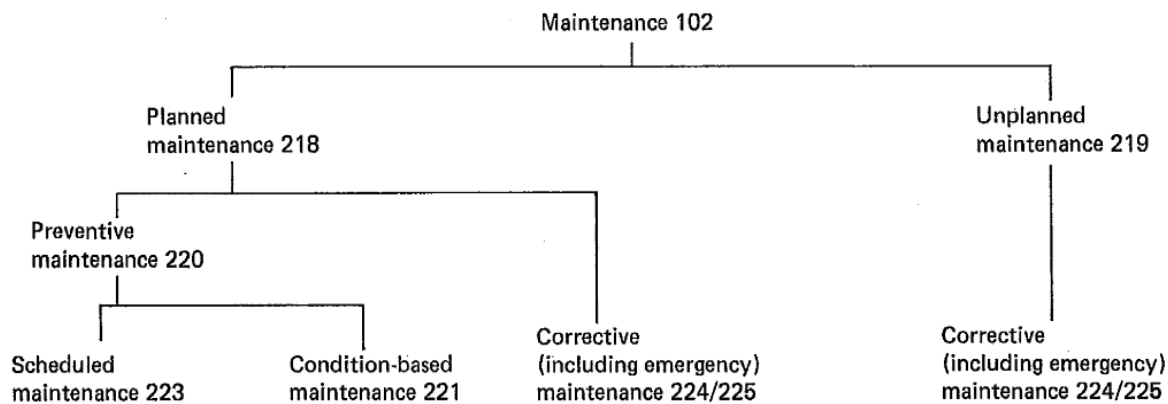


Figure1. Maintenance types (BS 3811, 1993)

Maintenance of buildings is a prevalent global concern closely tied to individuals' satisfaction with the service provided. However, organizations must reduce the number of issues that may arise to reach a uniform level of satisfaction (Dzulkifli et al., 2021). According to (Mydin, 2016), it is an operation done continuously to maintain the building safely and best for everyday use. By reducing deterioration, preserving the building's aesthetic, and promoting safety, maintenance can increase the value of the building, and by maintaining fire safety installations such as fire extinguishers, fire doors, fire hydrants, fire hose reels, emergency lighting, and smoke detectors, maintenance ensures the safety of building occupants. (Biadgign, 2021). Maintenance is a crucial component of facility management, as it aims to extend the lifespan of the building. However, it is important to note that maintenance activities are often associated with significant expenses (Reziej and Al-hilaly, 2017). The restoration efforts were considered insufficient for the building to operate at an optimal level, as this requires regular maintenance to preserve the physical condition of the building and its function and reduce the inconvenience during its operation (Rahman et al., 2012). If poor building maintenance is ignored, it will undoubtedly result in more damage and expensive repair work (Suffian, 2013). Building maintenance is a significant investment on a global scale when it comes to sustaining functionality and quality. Approximately 50% of the total construction turnover is devoted to building maintenance (Ebekozi, 2020). In the past, researchers and research centers mostly focused on issues related to the building process, such as project delays, cost overruns, and costs that were higher than expected. However, in recent years, there has been a shift in focus toward building maintenance practices. As a result, research on building maintenance has become increasingly appealing to researchers (Hauashdh et al., 2020).

This work aims to review publications that discuss the factors affecting building maintenance practices so that effective maintenance can be carried out with good quality at a reasonable cost and delivered on schedule.



2. FACTORS AFFECTING BUILDING MAINTENANCE PRACTICES.

This paper represents a literature review that deals with the issue of factors affecting building maintenance. The literature review results indicate that many factors affect building maintenance practice, and the following paragraphs explain some studies conducted to assess or evaluate building maintenance in terms of these issues. The review result showed 33 factors from a literature review, and the factors affecting building maintenance practices can be classified into six groups. Each group has several variables affecting building maintenance. These groups are organization-related factors, human resource-related factors, technical-related factors, financial-related factors, building user-related factors, and building characteristics-related factors.

2.1. Organization: Related Factors

This group includes ten factors, as given in **Table 1**.

Table 1. Summative of Organization- related factors.

Factor	Reference
The organizational structure and job description are not clear.	(Hauashdh et al., 2021; Alshehri et al., 2015)
Maintenance work is poorly planned and scheduled.	(Hassanain <i>et al.</i> , 2013; Ebekoziem, 2020; Bajere et al., 2016; Hauashdh et al., 2021)
Selection of unqualified maintenance contractors	(Jandali and Sweis, 2018; Alshehri et al., 2015; Hassanain et al., 2019; Ali et al., 2016; Chima et al., 2021; Waziri and Vanduhe, 2013)
Planned maintenance and regular inspections are not adopted.	(Aliyu et al., 2016; Hauashdh et al., 2021; Okosun and Olagunju, 2017; Fotovatfard and Heravi, 2021; Ofori et al., 2015)
Unresponsiveness to maintenance requests.	(Breesam and Jawad, 2021; Ogunbayo et al., 2022)
Construction and maintenance groups are not coordinated.	(Ofori et al., 2015; Jandali and Sweis, 2018; Hassanain et al., 2013; Waziri, 2016)
Lack of documentation of maintenance work	(Hussein and Oztas, 2020; Jesumoroti and Soo, 2021)
Non-application of user satisfaction survey	(Ohaedeghasi et al., 2021; Yong and Zailan Sulieman, 2015)
Corruption	(Dakhil et al., 2017; Ohaedeghasi et al., 2021; Adeyi, 2016; Ugwu et al., 2018; Ogunmakinde et al., 2013; Odeyemi et al., 2019; Ogunbayo et al., 2022)
There is no quality assessment of maintenance work.	(Hauashdh et al., 2021; Myeda and Pitt, 2014)



2.1.1. The organizational structure and job description are not clear.

To maintain a building successfully, a proper organizational structure and an adequate grasp of each employee's responsibilities (**Hauashdh et al., 2021**).

2.1.2. Maintenance work is poorly planned and scheduled.

The scheduling of maintenance activities significantly impacts maintenance costs (**Muyingo, 2017**). Insufficient planning and scheduling for maintenance work indicate that the organization is not relying on preventive maintenance.

2.1.3. Selection of unqualified maintenance contractors.

The effective performance of maintenance work depends on the expertise and experience of contractors. A reliable maintenance contractor understands costs and capabilities and acknowledges that their reputation is founded on previous achievements (**Ofori et al., 2015**). Unqualified contractors are incapable of providing skilled and proficient workers to execute tasks, leading to a potential loss of time and effort (**Ali et al., 2016**).

2.1.4. Planned maintenance and regular inspections are not adopted.

The lack of planned maintenance procedures is a contributing factor to the deterioration of buildings (**Chua et al., 2018; Rodrigues et al., 2018; Hauashdh et al., 2021**)

2.1.5. Unresponsiveness to maintenance requests.

Delay or non-response to a maintenance request results from facilities managers dealing with limited budget and personnel constraints. Determining the priority in responding to the maintenance request increases the satisfaction of the building users. This is because users who spend more time in buildings, such as hospital buildings, negatively react to the delay or lack of response to the maintenance request (**Cao et al., 2015**). (**Olanrewaju and Tan, 2022**) considered that user satisfaction is one of the factors that reveal the good performance of maintenance.

2.1.6. Construction and maintenance groups are not coordinated.

An uncoordinated maintenance and construction process negatively impacts a building's maintainability. To optimize the building's maintainability, it is essential for all members of the building team, including architects, planners, engineers, contractors, facility managers, and other key players in the construction industry, to collaborate and contribute towards the project's maintainability from the project's inception. Neglecting this collaborative effort may result in emergency maintenance challenges for the maintenance personnel towards the end of construction, which may be avoidable if addressed proactively during the project's design and construction stages (**Waziri, 2016**).

2.1.7. Lack of documentation of maintenance work.

In general, the documentation process is concerned with collecting information and providing access to records that have historical value (**Schleich et al., 2017**). Also, the outputs of the process of maintenance documentation are a set of maintenance instructions that help the maintenance staff complete their work more effectively and safely. **Fig. 2** represents the components of maintenance documents. Organizations may face difficulty

making appropriate decisions regarding maintenance in the event of a shortage of documents because the decision taken in the present is based on an understanding of the situation in the past (**Ebiloma et al., 2023**).

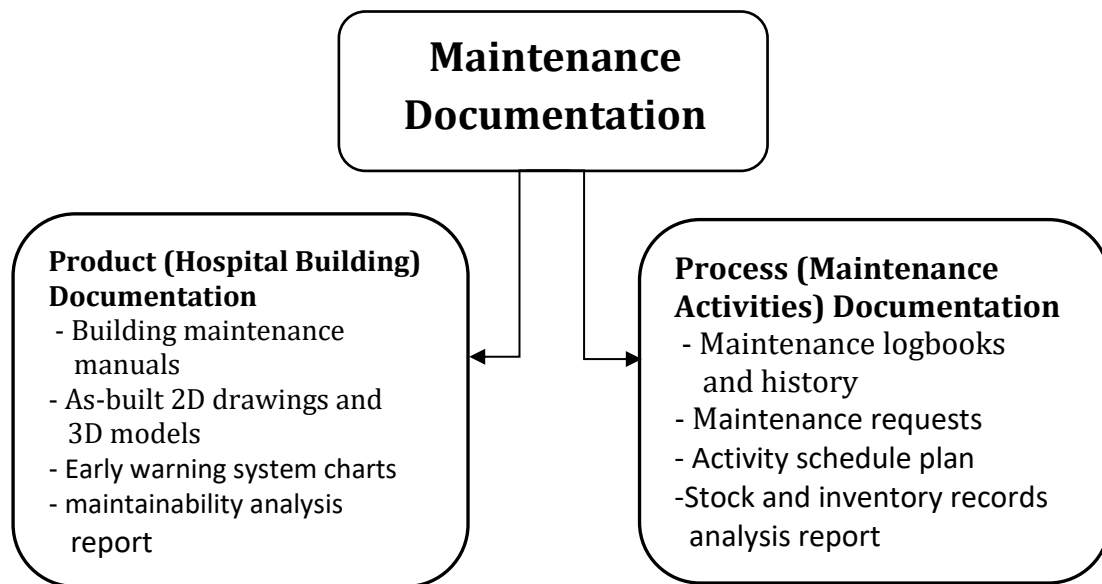


Figure 2. Components of maintenance documentation process (**Ebiloma et al., 2023**)

2.1.8. Non-application of user satisfaction survey.

(**Yong and Zailan Sulieman, 2015**) Failure to conduct user satisfaction surveys threatens the effective management of building maintenance. According to the authors, there is a possible relationship between maintenance management practices and occupant satisfaction because the maintenance department's provision of high-quality maintenance services contributes to improving the performance of the building, which in turn leads to increased user satisfaction with the state of the building.

2.1.9. Corruption.

One of the consequences of corruption is financial mismanagement, which results in limited financial resources (**Adeyi, 2016**), which can lead to delays in response to maintenance requests, resulting in delays in the completion of maintenance works. (**Dakhil et al., 2017**) found that corruption is the first barrier to implementing buildings.

2.1.10. No quality assessment of maintenance work

Insufficient verification and evaluation of contractor work by maintenance organizations are anticipated to result in substandard quality of maintenance work (**Myeda and Pitt, 2014**). The persistence of low-quality maintenance remains a critical challenge linked to numerous issues, including suboptimal building conditions and reduced building functionality. Such problems are attributed to inadequate comprehension of the stringent quality standards required for building maintenance (**Suffian, 2013**).



2.2. Human Resource-Related Factors

This group includes five factors, as given in **Table 2**.

Table 2. Summative of Human resource-related factors.

Factor	Reference
Lack of work experience	(Dzulkifli et al., 2021; Ugwu et al., 2018; Ohaedeghasi et al., 2021; Ebekoziem, 2020; Abdul-Rashid and Ahmad, 2011; Au-Yong et al., 2014)
Non-utilization of skilled maintenance personnel	(Ofori et al., 2015)
Inadequate training	(Salleh et al., 2016; Ohaedeghasi et al., 2021; Hauashdh et al., 2021; Dahal and Dahal, 2020; Al-Hammad et al., 1996; Ikediashi and Okwuashi, 2015)
Unavailability of skilled appointed maintenance personnel.	(Ebekoziem, 2020; Hassanain et al., 2019; Bajere et al., 2016; Waziri and Vanduhe, 2013)
shortage of maintenance staff	(Ohaedeghasi et al., 2021)

2.2.1. Lack of Work Experience.

This factor has been identified as the root cause of budget overruns (Dzulkifli et al., 2021) because skilled staff can avoid errors and omissions while carrying out maintenance work. Furthermore, a skilled technician can identify any anomalies in the system during maintenance, which leads to savings in the cost and time required to complete the maintenance work (Abdul-Rashid and Ahmed, 2011).

2.2.2. Non-utilization of Skilled Maintenance Personnel.

Building maintenance requires the involvement of skilled personnel. Thus, it is essential to hire maintenance personnel with the skills necessary. This procedure can result in better quality work, lower costs, and reduce the time required to complete maintenance activities (Ofori et al., 2015).

2.2.3. Inadequate Training.

Poor maintenance staff training poses a significant challenge to building maintenance in Nigeria (Aliyu et al., 2016) and contributes to poor maintenance work quality.

2.2.4. Unavailability of Skilled Appointed Maintenance Personnel

According to (Ali, 2009), the performance of the building can be measured through its maintenance cost. The maintenance performance can be calculated as the difference between the estimated and actual costs, so it can be assumed that good maintenance performance occurs when the actual cost is less than the estimated cost. One of the influences that increase the maintenance cost during implementation is the lack or absence



of maintenance staff with sufficient knowledge of maintenance work. Lack of knowledge leads to wasted resources and equipment misuse, resulting in undesirable outputs such as failure to identify and correct errors or a lack of checks during maintenance tasks **(Au-Yong et al., 2014)**.

2.2.5. Shortage of Maintenance Staff.

Maintenance activities are directly affected by the availability of a sufficient number of employees, as **(Morais and Júnior, 2018)** noted that the size of the maintenance staff must be adequate to meet maintenance requests to solve problems, especially those that require more services effectively. Also, **(Blessing et al., 2015)** found that the insufficient maintenance staff led to the non-fulfilment of the maintenance work and the institution’s reliance on corrective maintenance only. This results in slow maintenance performance or delays in the services provided by the building and thus reduces the level of user satisfaction with the building.

2.3. Technical-Related Factor.

This group includes seven factors, as given in **Table 3**.

Table 3. Summative of Technical-related factors.

Factor	Reference
Lack of maintenance planning at the building design stage	(Hauashdh et al., 2021; Zainol et al., 2014; Akanmu et al., 2020; Khalid et al., 2019)
Resolving construction problems in the maintenance phase	(Hassanain et al., 2013)
Inaccurate as-built drawings	(Hassanain et al., 2013; Ebekoziem, 2021; Hassanain et al., 2019)
Inadequate technology for detecting or evaluating defects in buildings	(Hauashdh et al., 2021)
Faulty design	(Hassanain et al., 2013; Salim et al., 2016; Ofori et al., 2015; Hassanain et al., 2019; Arditi and Nawakorawit, 1999; Salim et al., 2016; Assaf et al., 1996; Ishak et al., 2007; Islam et al., 2021; Saghatforoush et al., 2012; Razak and Jaafar, 2012; Omari, 2015)
Lack of adoption of building information modelling	(Hauashdh et al., 2021; Chen et al., 2018; Liu and Issa, 2014)
construction errors	(Arumsari et al., 2021)

2.3.1. Lack of Maintenance Planning at the Building Design Stage.

Integrating building maintenance practices during the planning and design phases offers substantial opportunities for achieving optimal maintenance outcomes. To this end, researchers advocate for adopting the design for maintenance concept, emphasizing the involvement of proficient building maintenance engineers during the design phase and providing guidance to assist designers in incorporating maintainability principles into their



designs. By implementing design for maintenance, future building maintenance success can be achieved **(Hauashdh et al., 2021)**.

2.3.2. Resolving Construction Problems in the Maintenance Phase.

Certain defects may be intentionally omitted from remediation in construction projects and left for maintenance contractors to address. This practice is typically due to the constraints of time and cost imposed on construction contractors. It is important to note that allowing such defects to persist can increase maintenance costs for the facility over time **(Hassanain et al., 2013)**.

2.3.3. Inaccurate As-Built Drawings.

Construction contractors sometimes fail to provide precise as-built drawings to facility owners, which maintenance contractors then use. Maintenance contractors may make erroneous assumptions when conditions differ from those depicted in the as-built drawings. Consequently, unnecessary time is spent on the job site, increasing maintenance costs. **(Hassanain et al., 2013)**.

2.3.4. Inadequate Technology for Detecting or Evaluating Defects in Buildings.

Advanced technology has the potential to enhance the efficiency of building maintenance teams and reduce associated costs. For instance, **(Chen et al., 2019)** proposed a Building Information Modeling (BIM)-based framework that can automate the scheduling of maintenance work orders. This framework offers automated decision-making capabilities for maintenance scheduling, saving facility managers time.

2.3.5. Faulty Design.

The rapid deterioration of building structures can be accelerated by faulty design. It is, therefore, essential to pay adequate attention to the maintenance needs of the building during the design phase to mitigate potential maintenance problems **(Olagunju, 2017)**.

2.3.6. Construction Errors

The primary cause of additional maintenance work in construction projects is construction errors, such as installing substandard materials and using ineffective construction methods. These errors necessitate rework and ongoing maintenance throughout the project's lifespan **(Hassanain et al., 2013)**. Design changes by the owner during construction

2.3.7. Lack of Adoption of Building Information Modeling.

BIM can be used to maintain existing and newly constructed buildings as a source of information to support planning and decision-making to manage building maintenance activities **(Hauashdh et al., 2021)**. The use of BIM at the design stage helps to investigate the maintainability of the building parts **(Liu and Issa, 2014)**. Also, using this tool in the operation phase helps plan maintenance activities by achieving the desired benefits from its use. Some benefits include analyzing breakdown trends under certain topological relationships and analyzing and visualizing the spatial relationships of work orders for more effective interactive and preventive maintenance **(Akcamete et al., 2010)**.



2.4. Financial-Related Factors

This group includes three factors, as given in **Table 4**.

Table 4. Summative of Financial-related factors.

Factor	Reference
Lack of funding	(Jandali and Sweis, 2018; Bajere et al., 2016; Abidin et al., 2010; Mazengia, 2021; Akinsola et al., 2012; Zolkafli et al., 2019; Ajayi, 2014; Amos et al., 2021)
Lack of proper planning for the allocation of the maintenance budget.	(Hauashdh et al., 2021; Mohd-Noor et al., 2011)
Failure to forecast accurate maintenance expenditures	(Hauashdh et al., 2021)

2.4.1. Lack of Funding.

Lack of funding is a significant factor that impacts maintenance activities' effectiveness. The availability of funds directly influences the scope of maintenance work and, in some instances, even determines the quality of materials used to maintain the building (Ebekozi, 2020). These financial constraints can negatively impact the overall performance and lifespan of the building and highlight the importance of proper financial planning for effective building maintenance.

2.4.2. Lack of Proper Planning for the Allocation of the Maintenance Budget.

The allocation of the maintenance budget required implementing appropriate methods to ensure optimal efficiency and systematicity of the budget. Failure to conform to an efficient and systematic budget allocation process may result in a budget overrun or deficiency, requiring additional funds to be sourced or suspending maintenance work. (Hauashdh et al., 2020).

2.4.3. Failure to Forecast Accurate Maintenance Expenditures.

The budget for future maintenance work is estimated based on experience and previous work. Therefore, these estimates may be inaccurate due to unexpected factors during the estimation process, affecting the actual maintenance cost (Hassanain et al., 2013).

2.5. Building's User-Related Factors.

This group includes four factors, as given in **Table 5**.

2.5.1. Misuse of building facilities.

Building users are often responsible for the deterioration of buildings, which usually takes various forms. An example is vandalism, which involves intentionally damaging or disfiguring a building. Using the building inappropriately will cause it to deteriorate and require more maintenance, which is costly (Ofori et al., 2015).

**Table 5.** Building's user-related factors.

Factor	Reference
Misuse of building facilities	(Ofori et al., 2015; Bajere et al., 2016; El-Haram and Horner, 2002)
Delayed report of building defects	(Hauashdh et al., 2021; Palis and Misnan, 2018)
Individual modifications	(Hassanain et al., 2013)
Occupant density	(Kajavathani and Ramachandra, 2022)

2.5.2. Delayed Report of Building Defects.

Early identification and reporting of building defects or issues can reduce maintenance-related expenses and enhance the efficiency of building operations and maintenance **(Tan, 2021)**

2.5.3. Occupant Density.

(Kajavathani and Ramachandra, 2022) find that the number of occupants of the building is highly affected by the maintenance cost.

2.5.4. Individual Modifications.

Individual modifications made by non-specialized staff to correct building deficiencies often lead to additional maintenance work. This problem could be bypassed if the team repaired the faults with the training and experience to perform maintenance work **(Hassanain et al., 2013)**.

2.6. Building's Characteristics-Related Factors

This group includes four factors, as given in **Table 6**.

2.6.1. Building Age.

There is a relationship between the age of the building and maintenance costs. The cost of maintenance increases with the age of the building due to some maintenance activities, such as repainting, replacing tiles, and other related works necessary to maintain the appearance of the building. In addition, the plumbing and drainage systems of older buildings require more frequent maintenance and repair due to problems such as corrosion. So, the cumulative maintenance costs of a building are likely to increase with age **(Ali et al., 2010)**.

2.6.2. Structure Condition.

If a building's structure is not in good condition, this can result in a range of maintenance problems. **(Breesam and Jawad, 2021)** find that structure condition affects building maintenance performance.

**Table 6.** Building’s characteristics related factors.

Factor	Reference
Building age	(Ali et al., 2010; Olagunju, 2017; El-Haram and Horner, 2002; Dahlan et al., 2019; Maduka, 2018; Geekiyanage and Ramachandra, 2018; Ihsan and Alshibani, 2018; Zeni and Kikwasi, 2021; Olorunlogbon and Adamu, 2021; Olubodun and Mole, 1999; Kerama, 2013; Muyingo, 2017; Perera et al., 2016; Chigozie and Jide, 2015; Doos et al., 2016)
Building Height and Building Area or Size There	(Breesam and Jawad, 2021; Kajavathani and Ramachandra, 2022; Che-Ghani et al., 2016; Kerama, 2017)
Structure condition	(Breesam and Jawad, 2021)
Building finishes and materials	(Ofori et al., 2015)

2.6.3. Building Height and Building Area or Size.

The height and size of the building directly affect the maintenance costs, as high buildings require special equipment, such as scaffolding, that helps carry out maintenance work. This procedure leads to an increase in the time and cost needed to complete the maintenance work. Therefore, facilities managers must take the height and size of the building into consideration when planning the maintenance budget (Kerama, 2017).

2.6.4. Building Finishes and Materials.

Using materials with specifications less than the required specifications in construction contributes to the deterioration or defect in the components of the building. In addition, the choices of low-quality materials used during maintenance throughout the facility or building component significantly affect maintenance costs, operating expenses, and the service life of the building (Ali et al., 2010). Fig. 3. represents a hypothetical model for factors affecting building maintenance practices.

3. CONCLUSIONS

Maintenance is an essential aspect of ensuring the longevity, safety, and functionality of any building. It encompasses many activities to preserve and repair a building's physical and mechanical components. Previous studies show that several factors have an impact on building maintenance practices. The findings of this review identified 33 factors affecting maintenance practice, categorized into six groups: organization-related factors, human resource-related factors, technical-related factors, financial-related factors, building user-related factors, and building characteristics-related factors. These factors can be used in the assessment of building maintenance. Finally, the study proposed a model of factors negatively affecting building maintenance practices.

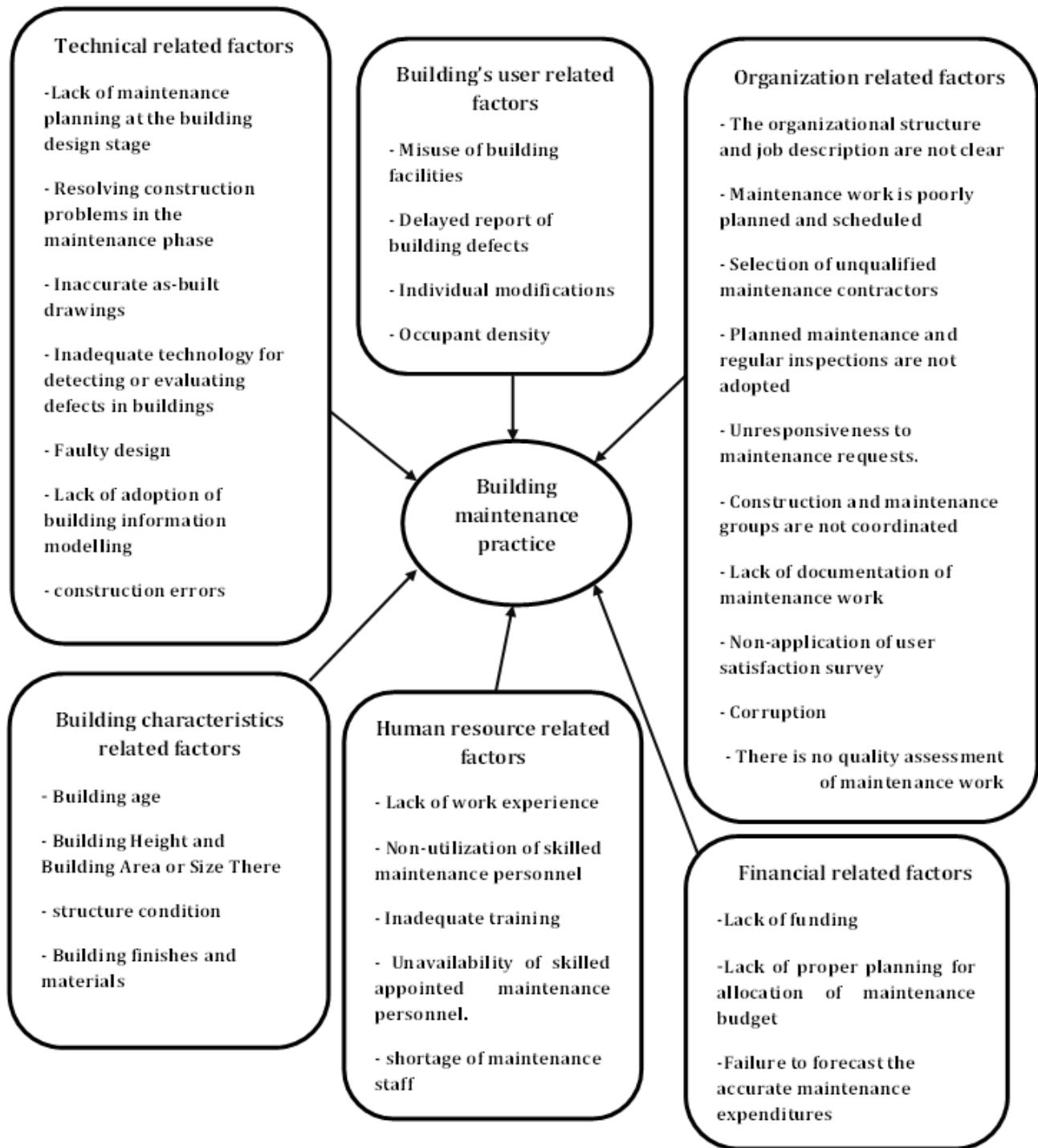


Figure 3. Proposed model of factors affecting building maintenance practice.

Future studies can test the relationship between these variables and building maintenance or measure the effect of these factors on building maintenance practice. Focusing on their consequences makes it possible to comprehend how building maintenance challenges impact the performance of maintenance organizations, maintenance services, and building performance. Furthermore, knowledge of the factors affecting building maintenance is critical for stakeholders in building maintenance. It enables them to plan and budget for



maintenance expenses more efficiently, implement preventive maintenance measures, reduce downtime, minimize operational costs, mitigate risks, and comply with legal requirements.

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