

Barriers and Challenges of Building Maintenance Management Practices for Public Universities in Perak

Milatulsamshi Abdul. Rahman¹, Mohd Asrul Hassin^{1*}, Mohammad Ashraf Abdul
Rahman², Farah Nieza Natasha Zainal Adnan³

¹Department of Building Surveying, University Teknologi MARA Perak Branch, Seri Iskandar, 32610, Malaysia

²Department of Civil Engineering Technology, Universiti Tun Hussein Onn Malaysia (UTHM), 86400 Parit Raja, Malaysia

³Cafam Sdn Bhd, Seri Iskandar, 32610 Perak, Malaysia

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ABSTRACT

This study investigates the barriers and challenges associated with building maintenance management practices at public universities in Perak, Malaysia. The research aims to identify maintenance teams' existing obstacles and determine the most critical factors hindering effective maintenance practices. This study used a quantitative methodology to identify the primary barriers and challenges that Public Universities in Perak face when implementing efficient building maintenance practices. One hundred questionnaires were distributed to maintenance management personnel from three (3) Public Universities in Perak. The questionnaire was developed using four (4) key barriers and challenges: maintenance management, technological issues, human resources, and financial constraints. A total of eighty-six (86) participants from three (3) public institutions successfully returned the questionnaire. The collected data is examined using Statistical Package for the Social Sciences, SPSS version-28. Means and percentages were calculated to rank the factors based on their criticality level. Findings reveal that inadequate funding, insufficient skilled personnel, aging infrastructure, and lack of advanced Information and Communication Technology (ICT) tools significantly impact maintenance management practices. The study emphasises the need for comprehensive strategies to address these challenges, ensuring the safety and functionality of university facilities. The recommendations aim to enhance maintenance effectiveness, supporting the overall improvement of academic environments and operational sustainability.

^{1*} Corresponding author. *E-mail address:* asrulhassin@uitm.edu.my
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INTRODUCTION

Periodic Maintenance is essential to ensure optimal structure efficiency over its entire lifespan. Maintenance encompasses the necessary activities and services carried out to uphold the structural soundness and operational efficiency of a building after its construction or any later repairs, restorations, or upgrades to meet present-day requirements. This definition clearly and unambiguously shows that Maintenance requires ongoing and never-ending labour. Furthermore, it is essential to acknowledge that Maintenance is not just contingent upon the state of the building. Maintenance generally aims to ensure that the facility operates by the expectations of its users. (Sanusi, 2019). Maintenance encompasses the regular examination of every element of a building and the performance of required actions to guarantee that the structure, finishes, and fittings are satisfactory. This encompasses both the interior and outside decorations. Persons in charge of building maintenance must comprehend that, by legal requirements, the building owner can be held liable for any incidents caused by negligence in the structure or its fixtures. (Che-Ani & Ali, 2019). Maintenance management encompasses the activities of strategising, synchronising, overseeing, and organising maintenance protocols and services with the aim of maximising return on investment. Typically, the maintenance management of university facilities in Malaysia is generally centred around fixing issues as they occur. At its worst, this approach relies on periodic inspections and corrective actions. However, Maintenance must now be approached proactively and not solely reliant on the outcomes of physical inspections. Maintenance management should integrate innovative concepts to utilise the resource's potential fully. This article examines explicitly the application of value management in the maintenance management of university buildings in Malaysia. To support and encourage educational, instructional, and intellectual activities, university facilities must be carefully designed to meet the essential space needs. Maintaining university buildings is vital to fostering an environment that promotes and enhances learning, teaching, innovation, and research. The primary goal of Maintenance is to guarantee, to the greatest extent possible, the building's uninterrupted and optimal functioning throughout its designated duration (Hauashdh et al., 2020). The objective of this research is to clarify the maintenance management system utilised by a university in Malaysia. Universities generally exist to participate in educational pursuits, which include teaching, learning, and research. To ensure these obligations' effective and efficient completion, public institutions necessitate top-notch infrastructure and a conducive environment. This atmosphere can only be created by well-maintained structures, as researchers have high criteria that ensure user comfort, promoting educational ideals in users' minds (Yasin et al., 2022). The administration of maintenance works for university facilities as an asset rather than a burden would be more beneficial. Moreover, the value of university buildings is contingent upon the extent of upkeep conducted by various universities (Olanrewaju Abdul Lateef, A, Mohd Faris Khamidi, 2018).

BUILDING MAINTENANCE

Building maintenance entails ensuring it remains in an ideal condition to accomplish its intended function. As per British Standard (BS) 3811, building Maintenance encompasses all actions to uphold or reinstate an asset to a satisfactory condition. This includes the tasks of cleaning, inspecting, and maybe utilising an analytical technique, as well as replacing and collaborating with different systems and components of the building (Dzulkifli et al., 2021). Maintenance management is organising and implementing maintenance tasks based on a predetermined policy. The administrative job of building maintenance oversight encompasses ensuring that all contractual obligations are met by all relevant parties, including the building owner, contractor, and maintenance management department (Falorca, 2019). In addition, Maintenance involves the methodical assessment of all components of a building and implementing appropriate actions to guarantee that the structure, finishes, and fittings are maintained in the best possible condition, both internally and externally (Razali et al., 2020). It is imperative for all persons in charge of building

Maintenance to understand that building owners can be legally liable for any occurrences resulting from negligence in the structure or its components

PUBLIC UNIVERSITIES

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IMPORTANCE OF MAINTENANCE

Maintenance in academic buildings is significant in fostering an environment favourable for learning, teaching, innovation, and research. The statement emphasises the need for upkeeping university buildings to safeguard, defend, improve, and attend to their materials and services, guaranteeing that they function as intended throughout their existence (Abdul-Lateef, 2010). Regular Maintenance is crucial for preserving and extending the lifespan of academic buildings, as it creates an ideal environment for scholarly activity and prevents malfunctions, damages, and increased future maintenance expenses. Effective building maintenance practices are crucial for ensuring the condition of university facilities, which substantially impacts students' academic results and the general reputation of the institution (Saverus, 2019). Within the realm of public universities in Malaysia, this remark underscores the significance of Maintenance in guaranteeing the effective operation of structures and averting deterioration that may curtail their longevity. This highlights the importance of effective Maintenance to maintain a favourable environment for educational, scholarly, and research activities and safeguard the value of facilities, preventing their deterioration for the university and its stakeholders. The proclamation emphasises public university facilities' long-lasting effectiveness and worth due to diligent upkeep (Yasin et al., 2022).

CURRENT PRACTICES FOR PUBLIC UNIVERSITY BUILDING MAINTENANCE

Preventive Maintenance

Planned Maintenance, a form of proactive Maintenance, plays a vital role in prolonging the lifespan of structures and reducing unexpected breakdowns. It is economically efficient compared to alternative forms of Maintenance and guarantees optimal performance of structures. Adopting planned Maintenance as the significant technique in maintenance management is highly recommended (Chua et al., 2018). Preventive Maintenance, a proactive approach, is highly effective in managing building maintenance in public

universities. Maintenance entails proactive measures to prevent prospective issues and preserve the integrity of a structure, facilitating early identification of defects and damages, hence reducing long-term maintenance expenses. Adopting this method is crucial for upkeeping university infrastructure, establishing a favorable atmosphere for academic pursuits, and bolstering the institution's overarching objectives (Saverus, 2019). Preventive maintenance involves scheduled operations at regular intervals to ensure that components remain in optimal functioning condition. This helps to minimise unexpected repairs and enables accurate calculation of costs. Proficient property managers undergo training to proactively avoid significant malfunctions, guaranteeing that facilities function optimally by conducting routine inspections and repairs. The objective is to detect and address minor flaws to prevent them from developing into major, expensive maintenance problems. Preventive Maintenance is most appropriate when assets are prone to foreseeable deterioration, breakdown patterns can be identified and accurately represented, assets are crucial for health and safety, and they can be efficiently managed through service contracts (MYDIN, 2016).

Condition Based Maintenance

Condition-based Maintenance (CBM) is the practice of conducting maintenance activities when there is a noticeable decline in the condition or performance of a unit, as evidenced by changes in monitored metrics. This technique is based on the idea that Maintenance is necessary when there are changes in the condition and regularity of an item. To make the most efficient use of CBM, it is crucial to schedule regular Maintenance at the most suitable intervals and conduct thorough inspections to identify any deterioration or tampering during regular operating hours (MYDIN, 2016). Within the framework of a Malaysian university, CBM refers to the assessment of the state of university buildings and engineering services using diverse monitoring techniques, including vibration analysis, oil analysis, thermography, and other non-destructive testing methods. Through ongoing surveillance of these assets, maintenance tasks can be planned according to immediate requirements instead of a predetermined schedule, leading to improved resource utilisation and decreased periods of inactivity. Introducing Condition-Based Maintenance (CBM) in a university context guarantees that buildings and facilities continually function optimally, thereby establishing a perfect environment for education, instruction, and research (Yasin et al., 2022).

BARRIERS AND CHALLENGES FOR MAINTENANCE MANAGEMENT BUILDINGS IN PUBLIC UNIVERSITIES

Maintenance Management

Several vital concerns impede the efficacy of maintenance management strategies in university student dorms. Several institutions have the challenge of not having a complete plan and policy in place for maintenance management, resulting in below-average practices. The shortcoming frequently arises from a lack of comprehension among the personnel in charge of maintenance management, leading to inadequate decision-making procedures (Sanusi, 2019). Moreover, local administrations in Malaysia sometimes receive criticism for their deficient leadership and governance, resulting in delays in maintenance work. This failure can potentially jeopardise the well-being and safety of individuals inside the building and frequently results in negative public perception (Hauashdh et al., 2020). Inconsistent procedures additionally complicate the maintenance management in student residences. Many staff workers suffer from a deficiency in experience and ability, and financial limitations worsen these difficulties. This inconsistency highlights the necessity for a consistently implemented maintenance management methodology (Sanusi, 2019). Furthermore, a notable constraint is the lack of a proactive maintenance approach, such as preventative Maintenance. Contrarily, maintenance businesses in Malaysia primarily depend on corrective

repairs, which might result in significant difficulties and subpar building performance (Hauashdh et al., 2020).

Technical

The efficacy of a building's structure is significantly impacted by its design and Maintenance. Poor design, especially in terms of maintenance accessibility, can make building features and components difficult for maintenance personnel to access, which makes regular upkeep and repairs more complicated. Constructing buildings focusing on future maintenance results in improved ability to address present and future requirements, hence decreasing the occurrence of flaws, costs associated with Maintenance, and difficulties linked to accessibility. Moreover, several university facilities are plagued by antiquated or decaying infrastructure, exacerbating maintenance management challenges. Aging buildings typically need more regular upkeep, and finding replacement parts might be complex (Hauashdh et al., 2020; Olanrewaju Abdul Lateef and Mohd Faris Khamidi, 2001). Moreover, the inadequate utilisation of Information and Communication Technology (ICT) in maintenance organisations worsens these problems. With current information and communication technology (ICT) progress, maintenance systems must adapt and improve to optimise decision-making, productivity, and problem-solving. Insufficient communication technologies and software tools can result in malfunctions or postponements in maintenance activities. Studies show that organisations that use modern communication technology for maintenance management experience fewer problems than those with limited or no technology. This highlights the significance of using these tools to enhance maintenance efficiency (Hauashdh et al., 2020).

Human Resources

Malaysia is currently experiencing a deficit of proficient building maintenance staff, resulting in delays and inefficiencies in the upkeep of intricate systems, including heating, ventilation, and air conditioning (HVAC). The scarcity of building maintenance professionals poses difficulties, as the tasks frequently demand specialised expertise and abilities, particularly considering the emergence of new technology (Hauashdh et al., 2020). Furthermore, there is a dearth of thorough standards for evaluating staff proficiency in building maintenance duties. Several university staff members are competent in specialised areas rather than generalists in all required domains, leading to inadequate maintenance procedures. The problem is worsened by insufficient training programs for maintenance personnel, which further reduces the quality of maintenance work (Sanusi, 2019). The lack of skilled personnel contributes to inadequate maintenance protocols, reducing asset efficiency and prolonged periods of inactivity (Olanrewaju Abdul Lateef and Mohd Faris Khamidi, 2001). Moreover, the maintenance department frequently experiences a deficiency in supervision, which poses a significant issue in Malaysian maintenance procedures. Efficient supervision is essential during the planning and management phases to guarantee that maintenance activities adhere to the standards established by senior management. Nevertheless, discrepancies in this supervision lead to inefficiencies and a deficiency in knowledge when it comes to managing maintenance tasks (Dzulkifli et al., 2021).

Financial

In Malaysia, the lack of adequate cash allocation significantly hampers the implementation of appropriate building maintenance techniques. The leading cause of this problem is the challenge property developers encounter when trying to collect maintenance fees from dissatisfied users who are unhappy with the condition of their buildings. This results in a financial deficit that hinders maintenance firms from effectively performing essential upkeep tasks (Hauashdh et al., 2020). Inadequate financing frequently leads to the abandonment of regular and routine Maintenance, prompting organisations to prioritise

remedial Maintenance over preventative actions. According to Abdul-Lateef (2010), adopting a reactive approach can lead to higher expenses and decreased asset performance in the long run. In addition, due to financial constraints, maintenance activities are sometimes delayed until enough money is obtained, with budgetary concerns taking precedence over specific maintenance requirements. The intricacy of budget allocation is further compounded by the lack of standardised contract laws and the difficulties in precisely predicting prices for different maintenance jobs. This frequently creates disparities between projected and actual costs, leading to conflicts between maintenance contractors and clients. Implementing a standardised method for allocating budgets is crucial to guarantee sufficient funding and effective management of maintenance work, hence solving the financial difficulties at hand (Yasin et al., 2022).

METHODOLOGY

This study used a quantitative methodology to identify the primary barriers and challenges that Public Universities in Perak face when implementing efficient building maintenance practices. The questionnaire was developed using factors identified in the literature. According to the literature, Public Universities encounter four (4) key barriers and challenges: maintenance management, technological issues, human resources, and financial constraints. The questionnaire is distributed to University A, University B, and University C maintenance departments in Perak.

The Likert scale was employed to ascertain the primary barriers and challenges that Public Universities in Perak encountered when implementing efficient building maintenance practices. The questionnaires were delivered to pertinent respondents from the internal maintenance teams and management organisations at these universities. A total of 86 participants from three (3) public institutions successfully returned the questionnaire. The collected data is examined using the SPSS version 28. Means and percentages were calculated to rank the factors based on their criticality level.

The Raosoft calculator recommended a sample size 86 to ensure the study results are within a 5% margin of error with 90% confidence. This sample size was deemed adequate for capturing reliable insights while maintaining feasibility in terms of data collection. The selection of three (3) public universities was deliberate, as Perak has only three (3) public universities. Including all three (3) ensures comprehensive coverage of the region's university maintenance practices and allows for findings generalisable to similar institutional contexts.

RESULTS AND DISCUSSION

The result was analyses based on barriers and challenges. The items for every factor were ranked to show the critical barriers and challenges in maintaining public universities in Perak.

Maintenance Management

Table 1. Maintenance Management Factor Ranked

Factors	Total Means	Percentage	Ranked	Factors
F1Q5	Poor maintenance quality has led to repeated problems or hazards in university building	4.49	21.73	1

F1Q2	Poor handling of maintenance issues due to staff incompetence has been a problem at the university.	4.13	19.98	2
F1Q4	The lack of preventative Maintenance leads to recurring maintenance issues in universities.	4.02	19.44	3
F1Q1	The lack of a comprehensive maintenance management plan and policy significantly affects the overall living conditions at the university.	4.02	19.44	4
F1Q3	Delayed maintenance tasks have affected my safety or comfort in the building.	4.01	19.40	5

Source: Authors (2025)

The biggest hindrance noted is the inadequate degree of Maintenance, resulting in recurring problems or hazards in the university infrastructure. This is the most critical issue, with a mean score of 4.49 and representing 21.73% (F1Q5). The impact of insufficient maintenance quality significantly impairs the safety and functionality of university infrastructure. The maintenance issues are poorly handled due to the staff's incompetence, with a mean score of 4.13 and a percentage of 19.98% (F1Q2). This deficiency in effectively handling maintenance responsibilities might worsen pre-existing problems, resulting in increasingly serious consequences over a period. The insufficiency of current preventive measures is a significant issue, ranking third with a mean score of 4.02 and a percentage of 19.44% (F1Q4). This indicates that the existing preventive Maintenance is inadequate in preventing repeating problems.

Furthermore, the lack of a thorough maintenance management plan and policy, which received a mean score of 4.02 and accounts for 19.44% (F1Q1), highlights the necessity for an efficient strategy to prevent interruptions in maintenance operations. Deferred maintenance tasks, with a mean score of 4.01 and a proportion of 19.40% (F1Q3), have a lower ranking but have an impact on operations by potentially creating delays or disruptions in maintenance work. These interconnected problems emphasise the urgent requirement for enhanced maintenance techniques in academic environments.

Technical

Table 2. Technical Factor Ranked

Factors	Total Means	Percentage	Ranked	Factors
F2Q4	Aged infrastructure in university buildings complicates maintenance management.	4.12	20.45	1
F2Q2	I have encountered challenges in maintaining building components due to poor design accessibility.	4.10	20.36	2
F2Q5	Maintenance operations are often delayed due to a lack of communication technologies and software tools.	4.06	20.16	3
F2Q3	I frequently encounter building flaws due to poor initial design.	4.03	20.00	4
F2Q1	Improper maintenance accessibility design at the building design stage makes it difficult for maintenance staff to access building elements and components	3.83	19.01	5

Source: Authors (2025)

The most significant technical impediment highlighted is the degraded infrastructure in university buildings, which considerably impacts maintenance management. The issue, with a mean score of 4.12 and

a percentage of 20.45% (F2Q4), suggests that older structures provide more intricate maintenance difficulties. In addition, the task of maintaining building components is made difficult by the lack of accessibility in their design. This is indicated by a mean score of 4.10 and a percentage of 20.36% (F2Q2). Lack of sufficient accessibility in design hinders the adequate performance of maintenance duties. The third significant issue is the regular delay of maintenance operations caused by insufficient communication technologies and software tools. This is indicated by an average score of 4.06, accounting for 20.16% of the total (F2Q5). This highlights the considerable barrier that technological deficiencies present to prompt remedies. Moreover, the high frequency of building defects resulting from insufficient initial design has an average rating of 4.03 and a proportion of 20.00% (F2Q3), indicating ongoing maintenance problems caused by design deficiencies. Furthermore, the insufficient accessibility design for maintenance reasons during the initial building design phase provides difficulties for maintenance personnel in accessing building elements and components. The data indicates that design faults substantially impact maintenance efforts, as seen by a mean score of 3.83 and a percentage of 19.01% (F2Q1).

Human Resource

Table 3. Human Resources Factor Ranked

Factors	Total Means	Percentage	Ranked	Factors
F3Q3	How would you agree the staffing performance levels in the maintenance department are unsatisfactory?	4.13	20.61	1
F3Q1	Are your maintenance staff generalists rather than specialists in a specific skill?	4.12	20.56	2
F3Q2	The lack of specialised knowledge affects the performance of maintenance tasks	3.95	19.71	3
F3Q4	Understaffing affects the efficiency of maintenance tasks in your organisation.	3.93	19.61	4
F3Q5	The lack of supervision is a significant issue in maintenance activities in your organisation.	3.91	19.51	5

Source: Authors (2025)

The main issue found is the insufficient performance levels of the maintenance department's workers, with an average score of 4.13 and representing 20.61% (F3Q3). This signifies a substantial problem with the overall efficiency of the maintenance personnel. Furthermore, the issue of maintenance staff possessing general knowledge rather than specialised expertise in specific abilities is consistently monitored, with an average score of 4.12 and a percentage of 20.56% (F3Q1). The absence of specialised skills has a negative impact on maintenance duties. The third primary problem is the lack of specialised expertise, which negatively affects the effectiveness of maintenance tasks. This is evident from the average score of 3.95 and a percentage of 19.71% (F3Q2). This highlights the necessity of acquiring specialised training and expertise to enhance maintenance efficiency. The problem of insufficient staff members, as shown by a mean score of 3.93 and accounting for 19.61% of the total (F3Q4), worsens the inefficiencies and delays in carrying out maintenance duties. Furthermore, the lack of proper supervision is identified as the fifth primary worry, with a mean score of 3.91 and a percentage of 19.51% (F3Q5), demonstrating that inadequate supervision plays a substantial role in the inefficiency of maintenance activities.

Financial

Table 4. Financial Factor Ranked

Factors	Total Means	Percentage	Ranked	Factors
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F4Q3	Based on your experience, does the lack of a maintenance budget affect the quality of work?	4.01	20.08	1
F4Q2	Is it due to financial constraints that maintenance activities are postponed?	4.00	20.03	2
F4Q3	Based on your experience, does the lack of maintenance budget affect the quality of work?	4.01	20.08	3
F4Q4	Does the budget allocation process affect your maintenance planning and execution?	3.99	19.98	4
F5Q5	Does the lack of a maintenance budget cause a dispute between the maintenance contractor and the university?	3.97	19.88	5

Source: Authors (2025)

The most significant financial concern noted is the detrimental effect of a deficient maintenance budget on the quality of work, scoring an average of 4.01 and representing 20.08% (F4Q3). This suggests that insufficient money impacts the quality of maintenance activities carried out. The second most prominent issues are the insufficiency of the current budget to support the upkeep of buildings and the financial constraints that result in delays in maintenance tasks. Both issues have an average score of 4.00 and make up 20.03% (F4Q1 and F4Q2), indicating that financial limitations are a significant obstacle, resulting in delayed and inadequate repair. The fourth major obstacle pertains to distributing funds, which has an average score of 3.99 and represents 19.98% (F4Q4). This implies that the way funds are distributed directly influences the efficiency and efficacy of maintenance operations. The fifth challenge noted is the inadequate funding distribution for Maintenance, resulting in disagreements between the maintenance contractor and the institution. The mean score of this issue is 3.97, representing 19.88% of the total. This suggests that financial concerns can cause arguments, making maintenance jobs more complicated.

Ranked Factors

Table 5. Ranked by Factors

Factors	Total Means	Percentage	Ranked
Maintenance Management	20.67	82.68%	1
Technical	20.14	80.56%	2
Human Resources	20.04	80.16%	3
Financial	19.97	79.88%	4

Source: Authors (2025)

The report assesses and classifies the elements that impact maintenance procedures in public universities in Perak by utilising total means and percentages. The most prominent feature discovered is maintenance management, with an average score of 20.67 and a percentage of 82.68%. This suggests that maintenance management difficulties have the most significant influence on the overall effectiveness of building maintenance. The technical elements are ranked as the second most crucial factor, with an average score of 20.14 and a percentage of 80.56%. This emphasises the enormous difficulties related to the infrastructure and architecture of buildings, which have a substantial impact on maintenance processes. Human resources are ranked third in importance, with an average score of 20.04 and a percentage of 80.16%. This highlights the significance of having sufficient staff, specialised knowledge, and adequate

supervision to preserve university buildings. The financial issues are ranked fourth, with an average score of 19.97 and a percentage of 79.88%. Despite being placed last, funding constraints remain substantial impediments that affect the quality, timeliness, and implementation of maintenance tasks.

DISCUSSION

The study identifies several key challenges and complexities in the areas of maintenance management, technological issues, human resources, and financial constraints. The primary topics of concern are the below-par level of maintenance quality (with an average score of 4.49), inadequate level of personnel competency (with an average score of 4.13), and insufficient implementation of preventative activities (with an average score of 4.02). These factors significantly impact the overall condition of the university facilities. The maintenance tasks are hindered by technology deficiencies, deteriorating infrastructure, and limited design accessibility, with average ratings of 4.06, 4.12, and 4.10, respectively. The maintenance efficiency is impeded by human resource challenges, such as the prevalence of generalists instead of specialists (mean score 4.12), insufficient personnel (mean score 3.93), and inadequate supervision (mean score 3.91). Financial constraints, adequate funds, and falsehearted budget allocation procedures exacerbate maintenance issues, leading to delayed work and disputes between contractors and universities, with average scores ranging from 4.00 to 4.01. The analysis reveals that maintenance management is the most pivotal component that influences overall maintenance practices, with a mean score of 20.67. It is closely followed by technical aspects, which have a mean score of 20.14. Human resources and financial issues also play significant roles, with mean scores of 20.04 and 19.97, respectively. These findings emphasise the importance of establishing comprehensive strategies to address these challenges, improve maintenance effectiveness, and ensure secure and functional academic environments.

CONCLUSION

Concluding this study on the obstacles and difficulties of implementing maintenance management methods for public universities in Perak, several crucial observations have been made. The study found that the absence of comprehensive maintenance management plans, inadequate handling of maintenance concerns, and delayed activities have a significant impact on the living conditions within university facilities. Maintenance operations are further complicated by technical obstacles such as subpar initial design, outdated infrastructure, and insufficient communication technology. Furthermore, the limitations imposed by human resource constraints, such as the requirement for specialised training and supervision, coupled with financial restrictions, provide substantial obstacles to achieving efficient Maintenance. Tackling these difficulties necessitates a comprehensive and diverse strategy. Implementing comprehensive maintenance management strategies and allocating resources towards state-of-the-art maintenance technologies helps optimise operations and enhance productivity. Specialised training is crucial for maintenance professionals to improve their competence and effectiveness. Sufficient financial resources must be allocated to prevent any delays and assure the high quality of maintenance work. Using these measures, universities can significantly enhance their maintenance practices, resulting in safer and more conducive learning and research environments. Ultimately, the sustainability and functionality of public university buildings in Perak heavily rely on efficient building maintenance management. Enhancing maintenance practices can be achieved by overcoming the listed barriers through strategic planning, technical improvements, specialised training, and proper budget allocation. These enhancements will establish a more favourable atmosphere for both students and staff, eventually fostering the long-term prosperity and viability of the universities.

RECOMMENDATION

(i) Comprehensive Maintenance Plans:

Creating thorough maintenance plans is crucial for structured and effective maintenance management. These plans facilitate the methodical organisation and implementation of maintenance chores, hence minimising unforeseen problems and prolonging the durability of equipment and infrastructure. Sanusi (2019) emphasises the importance of consistent and dependable maintenance methods for optimising organisational efficiency.

(ii) Training Programs:

It is crucial to implement training programs for maintenance staff to improve their skills and knowledge. Proficient people are more capable of carrying out their jobs with efficiency, resulting in reduced errors and enhanced maintenance quality. According to Sanusi (2019), continuous training is crucial for keeping workers informed about the most recent methods and technology, therefore upholding excellent standards.

(iii) High Standard and Regular Evaluation:

Implementing rigorous maintenance protocols and regularly assessing performance are crucial tactics. This guarantees the execution of maintenance tasks of superior quality and ongoing performance enhancement. Regular evaluations highlight areas that need development, ensuring that maintenance techniques are consistently high quality and can adjust to new obstacles. Sanusi (2019) and Smith & Taylor (2020) emphasise the significance of cultivating a culture that promotes excellence and accountability among maintenance personnel.

(iv) Advanced ICT Integration:

Efficiency in maintenance operations is enhanced by integrating sophisticated Information and Communication Technology (ICT). Information and Communication Technology (ICT) solutions offer the benefits of real-time data, predictive Maintenance, and improved team communication. This leads to quicker reactions and proactive initiatives. Haus'd et al. (2020) assert that the utilisation of modern information and communication technology (ICT) improves the process of Maintenance by minimising delays and increasing the overall effectiveness of operations.

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CONFLICT OF INTEREST STATEMENT

The authors agree that this research was conducted in the absence of any self-benefits, commercial or financial conflicts and declare the absence of conflicting interests with the funders.

AUTHORS' CONTRIBUTIONS

Milatusamshi Abdul Rahman carried out the research, wrote and revised the article. Mohd Asrul Hassin conceptualised the central research idea and provided the theoretical framework. Mohd Asrul Hassin supervised research progress; Mohd Asrul Hassin anchored the review, revisions and approved the article submission. Mohammad Ashraf bin Abdul Rahman review the article to be more precise and meet the requirement. Farah Nieza Natasha Binti Zainal Adnan reviewed the article according to the current practice from industry point of view.

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