Facilities Maintenance Management Practices at Higher Education Institutions

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Abstract

Higher Education Institutions (HEIs) play a pivotal role in national development by fostering knowledge creation, enhancing human capital, and fostering innovation. Despite their significance, HEIs often overlook maintenance management, crucial for sustaining infrastructure quality and functionality. This study examines Facility Maintenance Management practices in three (3) longstanding premier Kolej Komuniti in Selangor: Sabak Bernam, Selayang, and Kuala Langat. Using a quantitative approach with a sample of 91 respondents, data analysis reveals a preference for planned preventive maintenance over corrective measures. The data obtained was analyzed using IBM SPSS version 27.0 software. The respondents include users of the facility services at the Community College, such as top management, academic staff and administrative staff. The objective of this study is to identify the current maintenance management practices in Community Colleges, examine the issues and problems that arise, and suggest the best practices for maintaining campus building. Key findings underscore the importance of skilled personnel, proactive strategies, and adequate budget allocation. However, challenges such as insufficient planning, monitoring inefficiencies, and budgetary constraints persist. Recommendations emphasize the need for robust maintenance policies aligned with organizational goals and greater openness to addressing maintenance issues. Ultimately, implementing best practices in maintenance management can enhance the longevity and utility of Community College campuses, advancing strategic objectives and organizational effectiveness.

Keywords: Community College; Higher Education; Maintenance Management Practices.

1.0 Introduction

Institutions of Higher Education (HEIs) serve as vital pillars for knowledge dissemination, skill development, and community progress. Within this framework, facility maintenance is a critical aspect that is frequently overlooked in the pursuit of academic excellence and innovation. HEIs significantly contribute to national development by enhancing human resource quality, fostering knowledge generation, and promoting innovation (Budihardjo et al., 2021). Effective maintenance management is essential for sustaining the infrastructure required for academic, administrative, and community functions within HEIs.

Dzulkifli et al. (2021) highlight persistent inefficiencies in maintenance practices in Malaysia, emphasising issues related to planning, management, personnel efficiency, technology, and technical capabilities. The Community College System, supervised by the Department of Polytechnic Studies and Kolej Komuniti under the Ministry of Higher Education (Ismail & Mohd. Esa, 2022), includes 103 Kolej Komuniti across Malaysia, with approximately 11 located in Selangor. These institutions, managed by Public Higher Education Institutions (IPTA), underscore the importance of maintaining university buildings, which have historically been undervalued (Palis & Misnan, 2018). This study focuses on three Premier Kolej Komuniti in Selangor, each with over 15 years of operation.

This research is significant not only for academic researchers but also for HEI administrators, policymakers, and stakeholders dedicated to optimising operational efficiency and sustainability within higher education. It aims to identify issues that arise in building maintenance management practices at three (3) Community College campuses in the State of Selangor, namely Kolej Komuniti Selayang, Kolej Komuniti Sabak Bernam and Kolej Komuniti Kuala Langat. The main objective of this research is to study the current maintenance management practices used in Kolej Komuniti and identify the issues faced in building maintenance management in Community Colleges.

By revealing the intricacies of facility maintenance management, this study contributes valuable insights to the discourse on infrastructure management and organisational effectiveness in the realm of higher education. The demand for effective maintenance and repair strategies is increasing, driven by the need to enhance educational quality while minimising costs (Kim et al., 2021). Focusing on community college campuses, this study, titled "Facilities Maintenance Management Practices at Institutions of Higher Education," explores the unique challenges and protocols associated with maintaining facilities essential to academic, administrative, and community functions.

2.0 Methodology

Rajasekar et al. (2006) emphasize the importance of developing a suitable methodology for addressing a research problem. In this study, the questionnaire method is employed to investigate Facilities Maintenance Management Practices in three Community College buildings in the State of Selangor. Data will be collected through questionnaires distributed to 91 participants across the case studies.

The sources used for the literature review comprise primary, secondary, and tertiary works. First published reports, official documents such as white papers, and unpublished materials such as memorandum and letters are examples of primary literature sources, sometimes referred to as grey literature. Books and journals, for example, are examples of secondary literature sources. They are more easily available than primary literature and

are subsequent publications meant for a wider readership. Indexes, abstracts, encyclopedias, and bibliographies are examples of tertiary literature sources, also referred to as search tools, which are used to identify primary and secondary literature or to introduce a topic (Saunders et al., 2007). The literature resource available is shown in Figure 1 below.

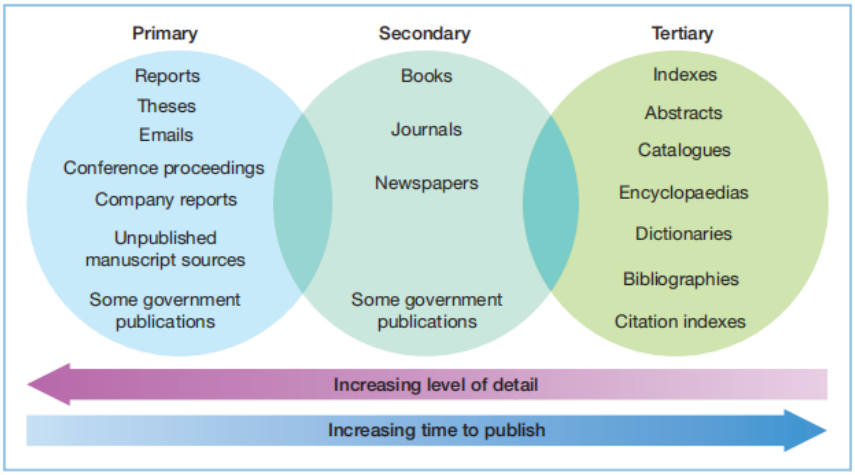

Figure 1: Literature Resource Available (Saunders et al., 2007)

The research utilizes both primary and secondary data. Primary data are gathered directly through surveys, while secondary data comprise information previously collected by researchers. Data that are fresh and first-time collections are considered original and are referred to as primary data. These informational pieces resemble raw materials (Thakur, 2019). Utilizing both sources of data is essential to achieving the research objectives. Figure 2 below, show the data collection design process for this study.

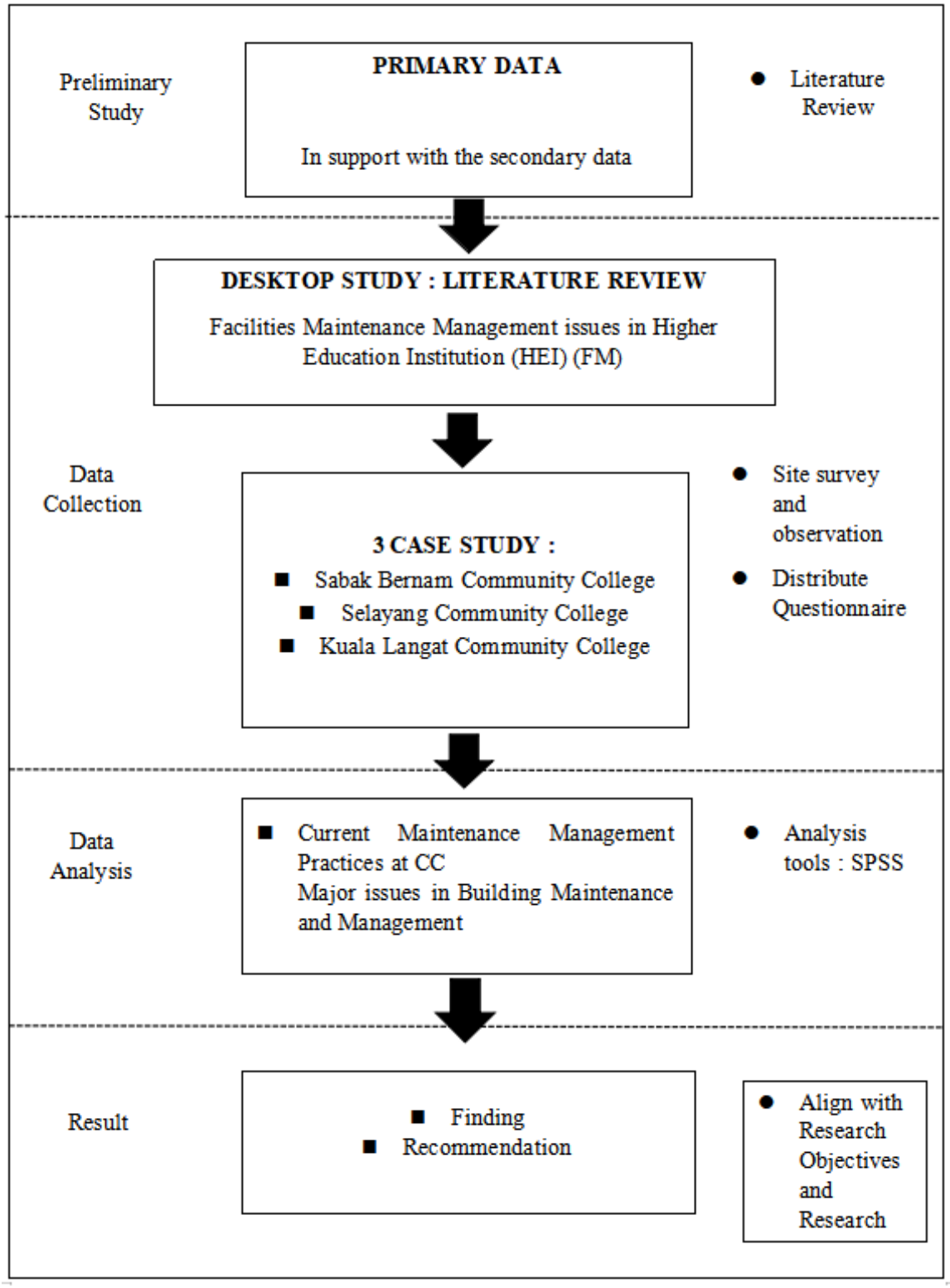

Figure 2: Data Collection Design Process

Data collection will be conducted using a quantitative approach, specifically through a questionnaire. The aim of the questionnaire is to gather accurate data to achieve the study's objectives. According to the Research Objectives, the research method has been divided into 3 steps and is thoroughly depicted in Figure 3 shown the data collection and methodology phases are listed below.

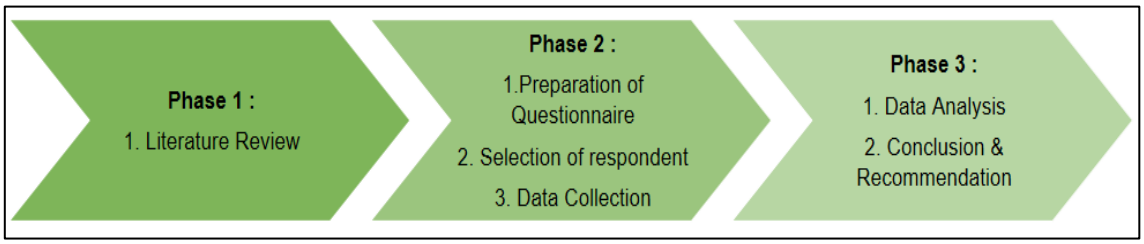

Figure 3: Data Collection and Methodology Phase

The success of a survey depends on the quality of its design (Rowley, 2014). For this research, a questionnaire comprising four sections has been distributed to Community College stakeholders. Each section addresses different aspects of Facilities Maintenance Management Practices at Community Colleges. Section A covers respondent demographics, Section B examines current maintenance management practices, and Section C identifies major issues in maintenance management.

The questionnaire was distributed to 91 respondents, including members of the maintenance unit, top management, lecturers and administrative staff from three (3) case studies: Kolej Komuniti Sabak Bernam, Kolej Komuniti Selayang, and Kolej Komuniti Kuala Langat. This case study was chosen because it has a campus style design as a higher education institution and all three of these institutions are premier campuses and have been over 15 years old.

All the data and results found in Sections A, B and C are analysed using SPPS descriptive analysis and the results will be explained through data analysis consists of 3 parts of a structured questionnaire. Structured questionnaires were designed individually for these case studies. The conceptual framework of questionnaire method will be described as table below:

Table 1: Conceptual Framework of Questionnaire Method

Measurement Item	Question Section
Part A Socio-Demographic	Gender Age Duration of Occupancy Department Community College
Part B Level of understanding the current Maintenance Management Practices at Community College	15 questions about the current maintenance management practices applied at Community College Building

Part C To identify the major issues faced in building maintenance management at Community College	10 questions about the issues faced in building maintenance management at Community College building

The sample size was calculated using Projectclue12., (2021) and the population that was acquired. The Statistical Package for the Social Science (SPSS) version 27.0 is used in this study's analytical approach. Frequency distributions were employed in SPSS to perform descriptive statistical analysis on the data. To ensure the study's statistical validity, the minimum number of respondents (n) was determined using Yamane formula:

$$\boldsymbol{n = \frac{N}{1+Ne^2}} \qquad (1)$$

Where:

- n = Number of samples,
- N = Total population and
- e = Standard error (5% = 0.05)

Equation (1) shows the study's effective population size (N) was 360. Since the sample error (e) was set at 0.05, the sample size 95% of the time appropriately reflects the population. The method produced 71.26 responses as the sample size (n), or 80% of the population (users of Community College office buildings). The researcher can determine the population sample size with the required level of accuracy by using Yamane formula. This formula offers instructions on how to choose the sample size to guarantee the researcher obtains data with a reasonable degree of accuracy.

3.0 Results and Discussion

The analysis in the first Section A of the questionnaire is regards to the demographic information of respondent for knowing the background of the respondent. There are ninety-one (91) of respondent among the staff of three Community College were participated in this questionnaire session. This section reveals the demographic information regarding the gender of respondents, the age of respondent, duration of occupancy, the department of respondent and the selected Community College respondent background.

Table 2 shows the demographic for this research. Community College such as Kolej Komuniti Sabak Bernam, Kolej Komuniti Selayang, and Kolej Komuniti Kuala Langat are included in the list of options for a Case Study. Each community college's share of the respondents is shown by the percentage distribution. Based on the Table 3.1 below, it shows the largest representation is found in Kolej Komuniti Sabak Bernam at 34.07% (31 responses) followed by Kolej Komuniti Selayang at 32.97% (30 responses), and Kolej Komuniti Kuala Langat at 32.97% (30 responses). This shows that the respondents of Sabak Bernam gave good cooperation to this study to help improve maintenance practices in their respective institutions.

Table 2: Summary of Respondent's Background

Respondent's Department	Kolej Komuniti Sabak Bernam	Kolej Komuniti Selayang	Kolej Komuniti Kuala Langat
	N	N	N
Top Management	2	6	3
Operation and Maintenance Unit	1	3	1
Academic Staff	19	3	11
Administration Staff	6	16	13
Others	3	2	2
Total Respondents	31	30	30
Percentage (%)	34.07%	32.97%	32.97%
Total of percentage (%)	100%		

The cross-tabulation data reveals insights into respondents' tenure at the three Community Colleges, as shown in Figure 4, Respondents with less than a year of service are uniformly distributed among the colleges, while KK Sabak Bernam has the highest proportion of respondents with 1-5 years of tenure at 46.40% (13 responses), followed by KK Selayang with 32.10% (9 responses) and KK Kuala Langat at 21.40% (6 responses), totalling 28 individuals. In the 6-10 years group, KK Kuala Langat has the largest representation at 46.70% (7 responses), followed by KK Sabak Bernam at 33.30% (5 responses) and KK Selayang at 20.00% (3 responses), with 15 respondents overall. For those with more than 10 years of service, KK Sabak Bernam again leads with 39.30% (11 responses), KK Selayang follows with 35.70% (10 responses), and KK Kuala Langat has 25.00% (7 responses), totalling 28 respondents. This cross-tabulation illustrates the tenure distribution across colleges, with a higher concentration in the 1-5 years and over 10 years categories; respondents with longer tenure are particularly valuable for their in-depth knowledge of maintenance practices within their respective Community Colleges.

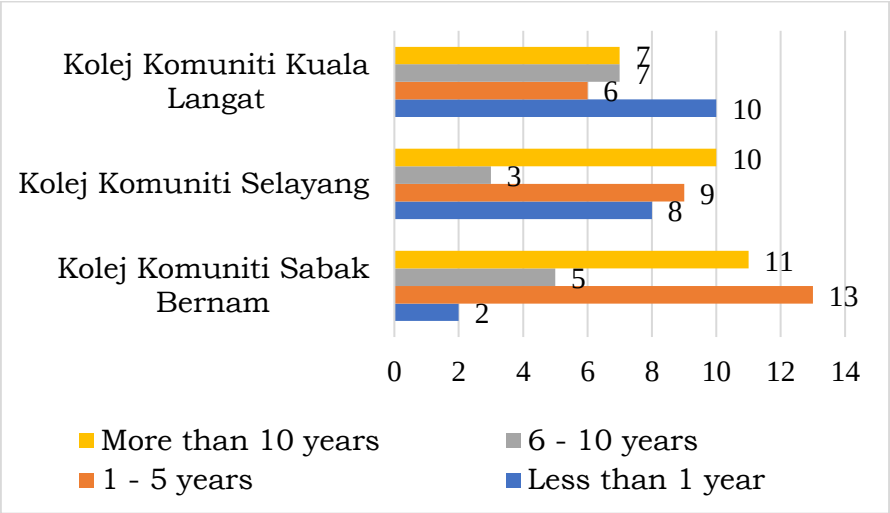

Figure 4: Summary of Occupancy Duration

3.1 Objectives 1: To Study the Current Maintenance Management Practices Applied at Community College

Analysis focuses on questions addressed to building occupants regarding the level of facility maintenance management, aiming to examine the current maintenance management practices used in Community Colleges. Seven (7) factors were identified as essential for effective Facility Maintenance Management practices namely; Maintenance Process, Maintenance Strategy (preventive and reactive maintenance), Maintenance Method (conventional or computerized), Maintenance Team (management and communication), Maintenance Procedures, Maintenance Policy, and Maintenance Cost and Financial Resources.

These seven factors were selected as foundational components for evaluating facility maintenance management because they collectively capture the core elements necessary for effective maintenance in Community Colleges. Each factor addresses a distinct aspect of maintenance management, from the procedures and resources involved to the technology and communication methods used, allowing for a comprehensive assessment of current practices. These factors are particularly relevant as they reflect both the operational efficiency and the long-term sustainability of maintenance practices. For instance, the Maintenance Process and Maintenance Strategy reveal whether proactive, preventive measures are prioritized over reactive approaches, which can affect the longevity and cost-efficiency of facilities. The Maintenance Method (conventional or computerized) indicates the institution's level of technological adoption, while Maintenance Team and Maintenance Procedures examine the communication and management practices that support timely responses to maintenance needs. Lastly, Maintenance Policy and Financial Resources are essential for ensuring that there are well-defined guidelines and sufficient budgeting to sustain maintenance efforts. Together, these factors form a solid framework for analysing the effectiveness of current maintenance practices and identifying areas for improvement.

As tabulated in Table 2, the highest mean score was for Item B6: *"I believe that preventing problems is better than solving them when they occur,"* with a mean 4.23. This high average indicates strong support among respondents for proactive maintenance practices. Rather than reacting to problems after they arise, respondents favour preventing issues before they occur. This suggests a positive attitude towards proactive maintenance techniques such as regular inspections, preventive maintenance plans, and early intervention. The belief that addressing problems before they escalate can save time and money aligns with the notion that prevention is more effective than reactive solutions. This perspective likely reflects the cost-conscious policies of community colleges. In summary, the data indicate that most respondents from each case study, support proactive maintenance practices, preferring to prevent problems before they arise. However, it was noted that disruptions on campus tend to be more reactive than preventative. There is a consensus that technical staff are well-trained in preventive measures, and that clear maintenance procedures are in place. Effective communication between building users and

maintenance staff is crucial for recording damage complaints and ensuring good feedback. Most of the respondents trust the Maintenance Team's credibility in overseeing program management and providing policy guidelines for maintenance-related tasks. Finally, budget requirements are deemed critical in maintenance management. Responsible parties need to allocate a special budget specifically for maintenance and repairs, as taking preventive measures is considered more economical in the long run.

Table 3: Frequency statistic for Current Maintenance Management Practices

Item Question	N	Mean
B6. I believe that preventing problems would be better than repairing them when they occur	91	4.23
B13.There is a clear procedure for making damage complaints provided by the maintenance unit	91	4.10
B7. Preventive maintenance tasks are scheduled and conducted regularly	91	4.03
B10.Do you feel that preventive actions require less cost in the long run compared to repairs	91	3.98
B11.The process of preparing the preventive maintenance schedule is carefully and structured	91	3.97
B12.Building users at the Community College feel that they can easily contact the maintenance department if there is a problem in the building	91	3.91

In summary, there are several issues highlighted that related to the maintenance management practices. Based on the analysis, most of the respondents support proactive maintenance practices implement in the higher education institutions. The findings indicate that while community college administrators have attempted to enhance maintenance management practices, significant gaps still exist that prevent optimal facility performance and user satisfaction. Although institutional leaders strive to streamline operations and minimize complications, the growing complexity of maintenance tasks necessitates a structured approach that meets the increasing demands placed on facility managers by upper management (Ntshebe et al., 2022b). Effective facility management requires not only managers with specialized administrative skills but also maintenance personnel who possess the necessary technical expertise, highlighting the importance of focused recruitment and training efforts.

Since the 1980s, facility management has expanded to encompass more than just physical infrastructure, integrating user needs and organizational objectives (Isa et al., 2016b). This comprehensive approach necessitates that facility managers address both building maintenance and the well-being of users, emphasizing the importance of strategic maintenance planning to avoid disruptions to educational activities (Olanrewaju & Abdul-Aziz, 2015). The majority of respondents support preventive maintenance, which is vital for avoiding costly repairs and ensuring the continuity of academic operations.

3.2 Objectives 2: To Identify the Major Issues Faced in The Building Maintenance Management at Community College

These findings highlight critical areas needing improvement to enhance the overall effectiveness of building maintenance management at the Community Colleges.

Table 4: Frequency Statistics for major issues in The Building Maintenance Management at Community College

Item Question	N	Mean
C7. Lack of budget is one of the main issues faced in the management of building maintenance at Kolej Komuniti	91	4.21
C1. Failure to maintain equipment and building systems has caused repeated disruptions in campus operations	91	4.01
C8. Lack of data management system and building maintenance technology is the cause of problems that often occur	91	3.90

The primary factor contributing to issues in building maintenance management at the community level is a lack of budget, with a mean score of 4.21. This shows that the majority of respondents strongly agree that a tight budget is the main problem for building maintenance management. Budget constraints are frequently cited as a primary factor affecting maintenance practices. According to a study by Kharabsheh et al. (2020), organizations often allocate insufficient funds for maintenance activities, leading to deferred maintenance and increased long-term costs.

With an average mean of 4.01, most respondents agree that frequent disruptions in campus operations stem from inadequate maintenance of building systems and equipment. The lack of technology and data management, with an average score of 3.90 is still a considerable issue but is perceived as slightly less severe compared to budget constraints and operational disruptions.

However, the lack of a structured monitoring system and an effective maintenance management framework has been identified, leading to frequent interruptions and increased operational costs. Many respondents pointed to budget limitations, outdated procedures, and unclear maintenance policies as key factors contributing to these issues, ultimately undermining the effectiveness of maintenance practices. In light of these findings, it is essential for college administrations to create comprehensive, long-term maintenance strategies that prioritize preventive measures and cost-effectiveness. Such strategies will not only enhance operational efficiency but also foster a more conducive learning environment for students and staff alike.

4.0 Conclusion

This research examines the state of maintenance management in Community Colleges, highlighting critical issues and proposing best practices for improvement. The analysis reveals that current procedures primarily involve corrective maintenance, focusing largely on addressing damage after it occurs. Key issues identified include inadequate maintenance of physical assets, insufficient funding, and outdated practices. To enhance maintenance management at Community Colleges, the researcher recommends implementing several strategies, such as transitioning to routine inspections and preventive maintenance, establishing clear maintenance policies, adopting a Computerized Maintenance Management System (CMMS), engaging in long-term planning, and providing staff development through training programs.

By enhancing facility management, improving communication channels, and adopting new technologies within the Community College context, these recommendations aim to foster a more effective, sustainable, and proactive maintenance management approach. The findings of this study are intended to assist Community College management units in delivering more organized and effective services. Management teams must address essential factors that impact user comfort to create a better working and learning environment. This research significantly contributes to the field of facilities maintenance in higher education by identifying key challenges and offering actionable strategies to enhance maintenance management. Ultimately, it supports ongoing efforts to improve the learning and working conditions in higher education institutions through effective facilities maintenance.

The findings highlight the critical need for Kolej Komuniti to prioritize the development of strong maintenance management policies. These policies should ensure adequate funding to support preventive maintenance initiatives and ongoing facility enhancements. Additionally, comprehensive maintenance frameworks should mandate the implementation of Computerized Maintenance Management Systems (CMMS) to streamline operations, enhance accountability, and improve tracking of maintenance activities. Policies should also prioritize enhancing training and development programs for maintenance staff to keep them updated on current best practices and technologies.

Furthermore, institutions should adopt a proactive approach to facility management by developing long-term plans that anticipate future needs and challenges instead of merely addressing existing issues. These policy implications are vital for fostering a conducive learning environment and enhancing the overall quality of educational services provided by Community Colleges. Future research could explore the long-term effectiveness of these practices, compare maintenance strategies across institutions, examine the impact of new technologies, and prioritize user experiences in maintenance strategies. This continued investigation could significantly advance maintenance management practices in higher education, enhancing overall institutional performance and user satisfaction.

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Author Contributions
S. L. Khusnin: Conceptualization, Methodology, Data Collection, Writing - Original Draft Preparation. **S. S. Judi**: Data Curation, Validation, Supervision, Review & Editing.

Conflict Of Interest
The manuscript has not been published anywhere else and is not being considered by any other journals. All authors have authorized the review, agree with the submission, and state that they have no conflicts of interest in the work.

References
Budihardjo, M. A., Ramadan, B. S., Putri, S. A., Wahyuningrum, I. F. S., & Muhammad, F. I. (2021). *Towards Sustainability in Higher-Education Institutions: Analysis of Contributing Factors and Appropriate Strategies. Sustainability, 13(12), 6562. https://doi.org/10.3390/su13126562*

Dzulkifli, N., Sarbini, N. N., Ibrahim, I. S., Abidin, N. I., Yahaya, F. M., & Nik Azizan, N. Z. (2021). *Review on maintenance issues toward building maintenance management best practices. Journal of Building Engineering, 44, 102985. https://doi.org/10.1016/j.jobe.2021.102985*

Ismail, A. S. (2022). *Designing Sustainable Barrier-Free Learning Facilities For Community Colleges [Review Of Designing Sustainable Barrier-Free Learning Facilities For Community Colleges]. Malaysian Journal of Sustainable Environment.*

Kim, J., Yum, S., Son, S., Son, K., & Bae, J. (2021). *Modeling deep neural networks to learn maintenance and repair costs of educational facilities. Buildings, 11(4), 165. https://doi.org/10.3390/buildings11040165*

Kharabsheh, R., Al-Sharif, A., & Al-Momani, A. (2020). *The impact of budget constraints on maintenance management in manufacturing industries. *International Journal of Production Research**, 58(12), 3678-3692. https://doi.org/10.1080/00207543.2019.1670963

Ntshebe, S., Mapuranga, M., Lose, T., & Lukman, Y. (2022). *Facility Maintenance Management and Its Effects on Employee Performance: A Positivist Approach. International Journal of Higher Education, 11(7), 47. https://doi.org/10.5430/ijhe.v11n7p47*

Olanrewaju, A. L., & Abdul-Aziz, A.-R. (2015). *Building Maintenance Processes and Practices. doi:10.1007/978-981-287-263-0*

Palis, P., & Saidin Misnan, M. (2018). *A Review of Key Factors That Affect University Building Maintenance Costs. International Journal of Engineering & Technology*, 7(3.25), 32. https://doi.org/10.14419/ijet.v7i3.25.17466

Projectclue12. (2021, July 8). Taro Yamane Formular In Calculatiing Sample Size For Research. Medium. https://projectclue1.medium.com/taro-yamane-formular-in-calculating-sample-size-for-research-92b93a39696c

Rajasekar, S., Pitchai, P. nathan, & Veerapadran, C. (2006). *Research Methodology. ResearchGate.https://www.researchgate.net/publication/2174858*

StudyMalaysia.com. (2015, March 13). *The Malaysian Higher Education System - An Overview*. StudyMalaysia.com; StudyMalaysia.com. https://studymalaysia.com/education/higher-education-in-malaysia/the-malaysian-higher-education-system-an-overview