

Enhancing Building Condition Assessment (BCA) Practices at UTHM: Identifying Challenges and Proposing Strategic Solutions

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Abstract

Building Condition Assessment (BCA) is an important procedure for maintaining the sustainability, functionality and safety of institutional buildings especially in university environments where usage is continuous. However, the lack of organised supporting systems, limited funds and manual evaluation processes often have an impact on how effectively BCA is implemented. The purpose of this study is to identify Universiti Tun Hussein Onn Malaysia's (UTHM) current BCA practices and implementation issues and to provide improvement solutions based on feedback from engineering practitioners. A mixed-method sequential approach was used with engineering practitioners completing a questionnaire survey after structured interviews with a selected group of UTHM staff. The information collected was evaluated using descriptive statistical analysis. The results show that BCA at UTHM is mostly carried out by manual inspections with the main barriers including a shortage of manpower, insufficient technical expertise, a lack of standard operating procedures and inconsistent management of data. The study comes to the conclusion that in order to improve the efficacy of BCA practices in institutional buildings, standardisation guidelines, enhanced staff training and an evolving implementation of digital tools are essential.

1. Introduction

Institutional buildings such as universities were used daily to support teaching, learning, research and administrative activities. Continuous use and high occupancy levels caused building elements to deteriorate over time. If building conditions were not properly monitored, defects could affect safety, comfort and overall building performance. The physical condition of buildings including their structural components, finishes and mechanical and electrical systems was frequently evaluated using Building Condition Assessment (BCA). BCA helped to identify defects determine their severity and support maintenance planning. In institutional environments, regular BCA was important to ensure buildings remained safe, functional and suitable for long-term use (Faqih & Zayed, 2021).

Building Condition Assessment (BCA) was a standard procedure used to evaluate the physical condition of buildings and their components, including structural elements, finishes and mechanical and electrical systems. The main purpose of BCA was to identify defects, assess the severity of deterioration and support maintenance decision-making. Previous studies highlighted that regular condition assessments helped organisations plan maintenance activities more effectively and reduce long-term repair costs (Dzulkifli et al., 2021).

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However, the implementation of BCA remained challenging in many institutions. Visual inspections and manual reporting were commonly used which frequently led to inconsistent and subjective evaluation results (Yacob et al., 2021). Maintenance activities were frequently reactive, where actions were only taken after failures became serious. This approach led to higher maintenance costs and increased risks to building users (Dzulkifli et al., 2021).

At Universiti Tun Hussein Onn Malaysia (UTHM), maintenance activities were conducted regularly, but BCA practices were not always implemented in a structured and standardised procedure. Gaps were identified in terms of manpower availability, technical competency, standard procedures and data management. If these issues were not addressed, maintenance activities could remain reactive and inefficient (Rahman et al., 2025). Therefore, this study aims to identify current Building Condition Assessment (BCA) practices at Universiti Tun Hussein Onn Malaysia (UTHM), examine the challenges faced during implementation and propose practical improvement strategies based on engineering practitioners' feedback.

2. Methodology

This study used a sequential mixed-method research approach. The methodology combined qualitative and quantitative approaches to address the research objectives. The qualitative phase focused on identifying current Building Condition Assessment (BCA) practices and implementation challenges, while the quantitative phase evaluated proposed improvement strategies based on feedback from engineering practitioners. This section discussed the materials used, research procedures, evaluation approach and data analysis strategy applied in the study.

2.1 Materials

The research instruments used in this study consisted of structured interview questions and a questionnaire survey. The structured interview questions were designed to obtain information on current Building Condition Assessment (BCA) practices, documentation methods and implementation challenges at Universiti Tun Hussein Onn Malaysia (UTHM). The questionnaire survey was developed to evaluate engineering practitioners' perceptions of proposed improvement strategies using a five-point Likert scale. MINITAB statistical software was used to support the analysis of quantitative data.

2.2 Research Procedure

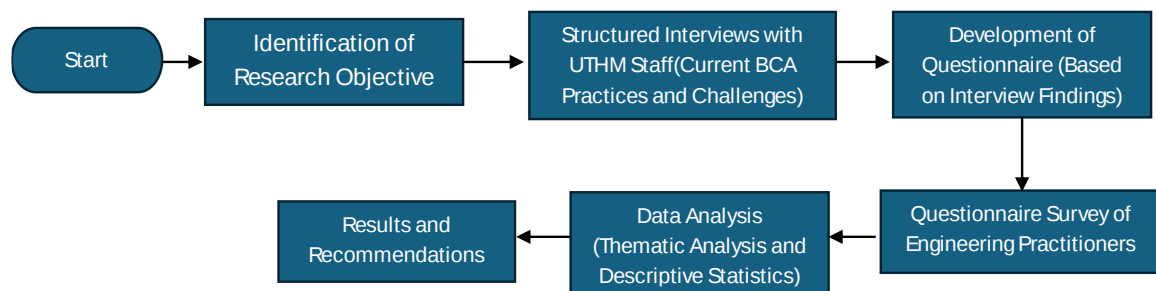


Fig.1 Flow of research methodology

The research was carried out in two sequential phases. Selected technical personnel involved with BCA implementation at UTHM were interviewed in structured interviews during the first phase. To ensure consistency in responses and identify important procedures and challenges, a structural set of interview questions was used. A total of 3 technical personnel participated in the structured interview phase, and the completed responses were collected and prepared for further qualitative analysis. The completed responses were collected and prepared for further analysis.

Based on the results of the interviews, a questionnaire survey was created in the second phase. For the quantitative phase, 35 questionnaires were distributed to engineering professionals involved in building maintenance and condition assessment, and 34 valid responses were received and analysed.

2.3 Characterization of BCA Practices

In this study, characterization referred to the evaluation of current Building Condition Assessment (BCA) practices and proposed improvement strategies. The evaluation focused on several key parameters, including the level of standardisation in assessment procedures, availability of technical competency, sufficiency of manpower and effectiveness of data management practices. These parameters were assessed based on responses obtained from structured interviews and questionnaire surveys to determine the overall effectiveness of existing BCA implementation at Universiti Tun Hussein Onn Malaysia (UTHM).

2.4 Data Analytic Strategy

Qualitative data obtained from structured interviews were analysed using thematic analysis. Interview responses were reviewed, coded and grouped into key themes representing current BCA practices and implementation challenges. Quantitative data collected from the questionnaire survey were analysed using descriptive statistical methods, including frequency distribution, percentage analysis and ranking. MINITAB statistical software was used to support the analysis and distribution of results.

3. Results and Discussion

This section presents the main findings of the study based on structured interviews and questionnaire survey responses from engineering practitioners involved in Building Condition Assessment (BCA) practices.

3.1 Result 1: Current BCA Practices at UTHM

The results of the structured interviews showed that manual inspections were the main method used at Universiti Tun Hussein Onn Malaysia (UTHM) for Building Condition Assessment. Building conditions were usually documented using basic methods like documentation and visual observation. Instead of systematic condition monitoring, the assessment procedure mainly focused on detecting obvious defects. Interview respondents reported that BCA activities were usually carried out during routine maintenance works or after user complaints were received.

Table 1. Summary of Current BCA Practices at UTHM

Aspect	Summary of Findings
Assessment method	Building Condition Assessment was mainly conducted through manual inspection
Documentation	Assessment records were maintained using basic and non-integrated documentation
Assessment frequency	BCA activities were carried out during routine maintenance or after complaints
Use of assessment results	Limited use for long-term maintenance planning

This finding indicates that BCA at UTHM was primarily implemented as a reactive maintenance practice rather than a proactive condition monitoring approach, which limited its effectiveness in early defect detection and preventive maintenance planning. This reactive approach limits the potential of BCA as a preventive tool for early defect detection and long-term maintenance planning in institutional buildings.

3.2 Result 2: Challenges in Implementing BCA

The findings from both structured interviews and the questionnaire survey revealed several challenges that affected the effective implementation of Building Condition Assessment (BCA) at Universiti Tun Hussein Onn Malaysia (UTHM). One of the main challenges identified was limited manpower which restricted the frequency and coverage of assessment activities. Respondents reported that staff were often required to handle multiple maintenance tasks, leaving limited time for systematic BCA implementation.

Another significant challenge was the varying level of technical competency among personnel involved in BCA activities. Differences in experience and expertise resulted in inconsistent assessment outcomes. In addition, the absence of standardised assessment procedures led to variations in inspection methods and reporting practices. Inconsistent data management practices further limited the use of assessment records for long-term maintenance planning. Additionally, time constraints and workload pressure were also reported as contributing factors that reduced the consistency of BCA implementation across campus buildings. Table 2 summaries the key challenges

identified from the study, while Fig. 2 presents the percentage distribution of respondents reporting each challenge.

Table 2. Challenges Affecting BCA Implementation at UTHM

Challenge	Percentage of Respondents %	Level of Impact
Limited manpower	86.7	High
Technical competency	80	High
Lack of standardised procedures	20	Moderate
Data management integration	93.3	High
Limited budget allocation	20	Moderate
Time constraints	60	Moderate

The percentage distribution analysis showed that limited manpower and technical competency were among the most frequently reported challenges affecting BCA implementation. The summary of challenges and their impact levels is presented in Table 2.

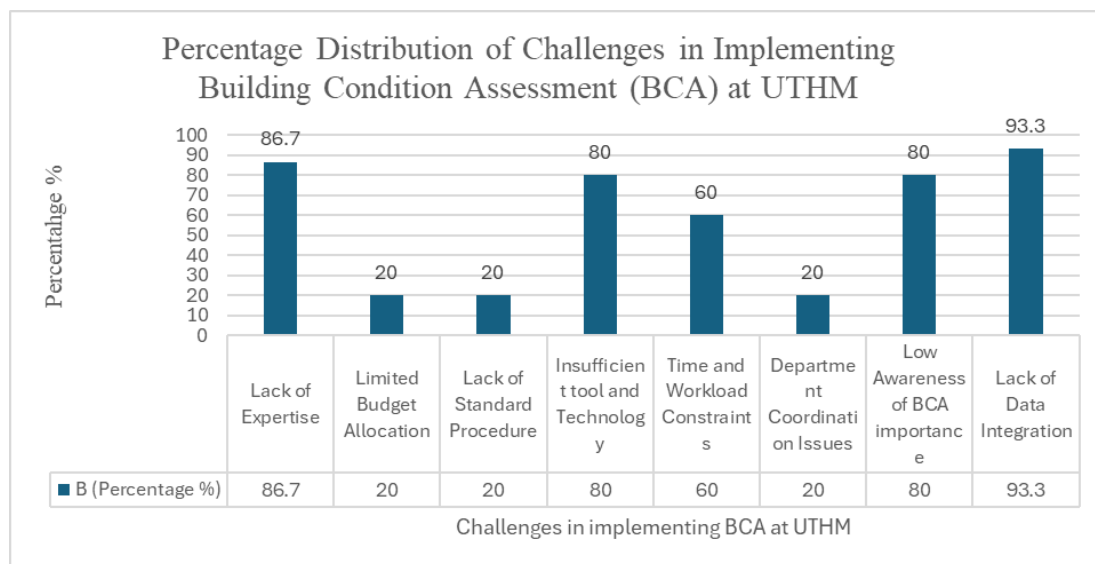


Fig 2. Percentage distribution of challenges in implementing BCA at UTHM.

The percentage distribution analysis shown in Fig. 2 indicated that data integration issues and technical competency were the most frequently reported challenges affecting BCA implementation at UTHM. A significant proportion of respondents also highlighted limitations related to insufficient tools and technological support, further emphasising the importance of system readiness in assessment activities. In contrast, challenges related to budget allocation and standard operating procedures were reported by a smaller proportion of respondents. Overall, the findings suggest that technical capability and system support had a greater influence on BCA implementation effectiveness than organisational and financial factors especially in ensuring assessment accuracy and accessibility of condition data. This indicates that practitioners prioritised operational effectiveness and data accessibility over financial considerations, as data management integration was perceived to have a more immediate impact on assessment accuracy and maintenance decision-making compared to budget allocation, which was rated as having a moderate impact. Budget allocation, while important, was viewed as a secondary concern when existing processes and data systems were not yet fully optimised. This finding aligns with previous studies which reported that limited manpower and technical competency are major barriers to effective Building Condition Assessment implementation in institutional buildings (Ali et al., 2020; Au-Yong et al., 2021). Similar challenges related to lack of data management were also highlighted in studies on digital facility management systems in higher education institutions (Marzouk & Abdelkader, 2021).

3.3 Result 3: Preferred Improvement Strategies

The questionnaire survey results in Table 3 indicated strong agreement among respondents on the need to improve current Building Condition Assessment (BCA) practices at Universiti Tun Hussein Onn Malaysia (UTHM).

Based on respondents opinions of effectiveness and amount of agreement, a variety of improvement strategies were evaluated. The results showed that the most important strategy for improving BCA implementation was the development of standardisation BCA guidelines and standard operating procedures.

Enhancing staff training and technical expertise was also given the highest priority highlighting the importance of highlighting the importance of having experienced personnel to ensure accurate evaluation outcomes. Furthermore, respondents agreed that the gradual integration of suitable digital technology could simplify inspection operations and enhance the effectiveness of data management. Examples of digital tools highlighted by respondents included mobile-based inspection applications for onsite condition reporting, centralised maintenance databases for storing assessment records and digital reporting platforms to improve documentation consistency and data accessibility. This preference for gradual digital integration is consistent with earlier research, which emphasised the importance of organisational readiness and user acceptance before full-scale implementation of digital facility management systems (Shohet & Lavy, 2022). In order to assure the effective and long lasting implementation of the proposed improvement strategies, management support was also shown to be important.

Table 3. Ranking of Proposed BCA Improvement Strategies

Rank	Improvement Strategy	Level of Agreement
1	Development of standardised BCA guidelines and SOP	Highest
2	Improvement of staff training and technical competency	High
3	Gradual integration of digital technologies	Moderate-High
4	Management and financial support	Moderate
5	Improvement of data management systems	Moderate

Fig. 3 presents the percentage distribution of respondents preferred improvement strategies for enhancing Building Condition Assessment (BCA) implementation at Universiti Tun Hussein Onn Malaysia (UTHM). The results show that improvement of staff training and technical competency was the most preferred strategy selected by 32.35% of respondents. This was followed by the development of standardised BCA guidelines and SOP (26.47%) and the integration of digital technology (23.53%). Hence, a smaller proportion of respondents prioritised improvements in data management and reporting systems (14.71%), while management and financial support was selected by only 2.94% of respondents. Overall, the results show that engineering practitioners prioritised strategies that directly enhance operational capability and assessment accuracy before higher-level organisational and financial support measures.

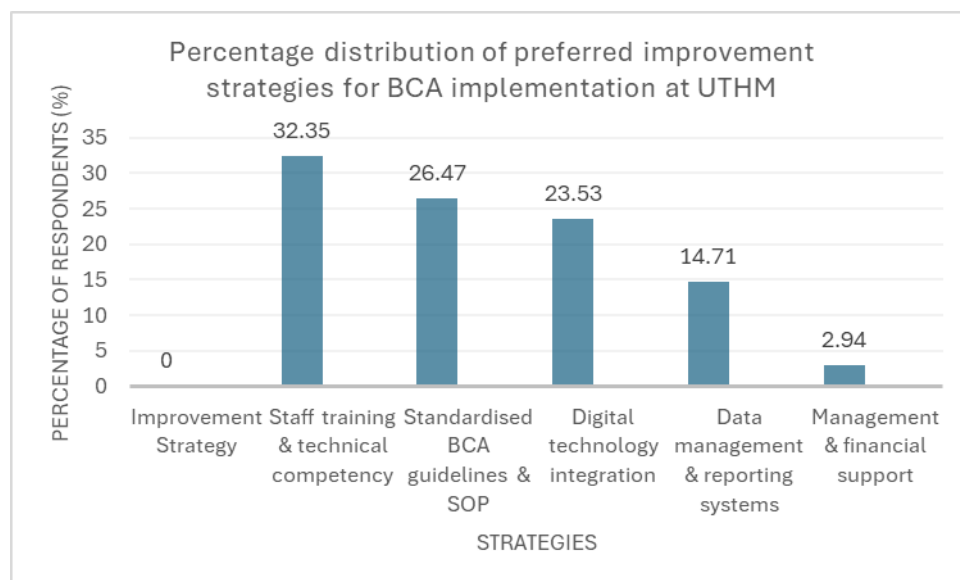


Fig 3. Percentage Distribution of Preferred Improvement Strategies for BCA implementation at UTHM

The preference for staff training and technical competency shows that respondents prioritised improvements that directly influence assessment accuracy and onsite decision-making. Similarly, the high selection of

standardised guidelines suggests that consistency in procedures was viewed as a necessary basic before advancing towards further digitalisation initiatives. These results provide an outline for the suggested strategy to improve human skills, standardised assessment procedures and encourage a potential digitization of BCA activities at UTHM.

4. Recommendation

Based on the findings of this study, several recommendations were proposed to improve the implementation of Building Condition Assessment (BCA) at Universiti Tun Hussein Onn Malaysia (UTHM). The development of standardised BCA guidelines and standard operating procedures was strongly recommended to ensure consistency in assessment methods and reporting practices across campus buildings. Clear guidelines would help reduce dependency on individual opinions and improve the reliability of assessment outcomes.

In addition, improvement of staff training and technical competency was recommended to enhance the effectiveness of BCA implementation. Regular workshops could improve manpower knowledge of documentation requirements, defect identification and assessment standards. The recommendation was particularly important because the data showed that differences in knowledge and expertise levels resulted in inconsistent assessment outcomes.

Furthermore, it was also suggested that suitable digital technology be slowly integrated to enhance data management processes and support inspection procedures. Digital tools could help with long-term maintenance planning, data accessibility and assessment record management. To ensure workforce preparedness and compatibility with current procedures, technological advances should be adopted slowly. Furthermore, continuous management support was recommended to ensure sufficient resources, coordination and long-term commitment towards sustainable BCA improvement initiatives.

5. Conclusion

This study identified the current practices and challenges of Building Condition Assessment (BCA) implementation at Universiti Tun Hussein Onn Malaysia (UTHM). The findings showed that BCA was mainly conducted through manual inspections with limitations related to manpower, technical competency, standard procedures and data management. Based on the findings, standardised BCA guidelines, improved staff training and gradual integration of digital technologies were proposed to enhance assessment effectiveness. Future studies should focus on comparative analysis across institutions and evaluate the performance of digital BCA systems in supporting sustainable building maintenance.

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