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EDUCATIONAL BUILDING PERFORMANCE EVALUATION PRACTICES AND PERCEPTIONS: A CASE OF FEDERAL UNIVERSITIES IN SOUTH EAST NIGERIA

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Abstract
This paper assesses the level of awareness, perception and practice of Building Performance Evaluation (BPE) in the management of educational buildings. Hitherto performance evaluation of buildings has not received significant attention in Nigerian Universities. Universities procure buildings that neither respond to the demands of changing needs, nor fit for purpose. This study relies on current literature to explore how the constructs of BPE can be utilized to improve the design and management of educational buildings in the Nigerian university system. Data were generated using a convenient sample of construction professionals holding key positions in the physical planning and works departments of four Federal Universities in South East Nigeria. Data analyses were conducted using Excel and statistica; Version 9.0. The findings suggest that there appears to be an apparent lack of a systematic mechanism for measuring the success or performance of completed and occupied buildings in the universities. The absence of a performance evaluation database in the institutions explains this situation. The study reveals inadequate funding and lack of skilled personnel to conduct the performance evaluation of buildings. Consequently, the interaction between users and buildings did not add value to learning and working experiences. The paper concludes that a significant number of buildings in the case organisations were not fit for purpose. Furthermore, building performance indicators/measures identified as specific design objectives seem not have been explicitly expressed in most of the buildings investigated. The study emphasizes the need for designers and facilities managers to acquire skills on critical aspects of building performance evaluation as a means of meeting the increasing demand for higher quality in education. The exploratory nature of this research clarifies the problems that need to be addressed in future studies and so raised a number of theoretical and conceptual issues that must be explored in the performance evaluation of educational buildings.

Keywords: Educational buildings, learning spaces, Nigeria, Performance Evaluation, Universities,

INTRODUCTION

Buildings are important to all businesses and organizations. The cost of these assets alone should make them a resource that is high on the agenda of business managers. This applies to all organizations including educational institutions. In the current times of high operating costs, increasing competition and rising user-expectations, educational institutions, particularly universities must seek to maximize their return on building investments. Building performance evaluation facilitates the realization of this objective (Amaratunga and Baldry, 2000). Although interest in building performance evaluation has significantly increased in recent years, anecdotal evidence shows that the concept is a far more mainstream activity in the United States of America, Australia and some European countries than it is in Africa (Amaratunga and Baldry, 2000).

To date, little data is available in Africa to assess how extensively the use of the technique has diffused in educational institutions or how it affects teaching spaces and overall organizational performance (Amaratunga and Baldry, 2000; Mutlaq, 2002; Zimring and Rashidi, 2008). Currently, the concept of building performance evaluation is little understood and therefore not well established among construction professionals in the Nigerian university system. Given the fact that the higher education sector is in urgent need for improved infrastructural development especially building facilities, there is need to address this problem by providing a clear theoretical understanding of the basic constructs and related concepts of building performance evaluation as well as its application in construction and management of educational buildings. This study seeks to identify the critical aspects of building performance and related concepts in facilities management and how they can be successfully integrated into the operations of educational buildings so as to attain key educational objectives. The case studies explore whether the universities have moved from the technical approach of managing buildings to the one in which the users' needs are supported by both the physical conditions and functional effectiveness of the buildings

PURPOSE/OBJECTIVES OF STUDY

The broad purpose of this study is to evaluate the level of practice and perception of building performance evaluation and how the concept can be utilized to improve the performance and

management of educational buildings. To this end, the specific objectives of the study include:

- To establish the concept of educational building design and identify the key performance indicators in buildings;
- To Appraise the nature and type of building facilities in the targeted universities;
- To establish the challenges or barriers to the practice of building performance evaluation in the targeted Universities; and
- To explore the practical and contextual issues to improving the evaluation process of educational buildings

THE CONCEPT OF EDUCATIONAL BUILDING DESIGN

Until the middle of the twentieth century, building design concepts for educational institutions did not evolve. Prior to this time, those who design educational buildings had assumed that as long as certain minimum standards for size, acoustics, lighting and heating were met, a productive environment existed; teaching and learning process would proceed normally (Mutlaq, 2002). The relationship between the school physical environment and learning was not given a serious consideration. It was felt that the environment only affected the consciousness when it caused particular pleasure, harm, discomfort or stress (Mutlaq, 2002; Watson and Thompson, 2005). By the mid 1970s, designers had begun to perceive educational facilities as revolving around sound educational programmes. This is because the physical environment and learning can not be separated and are considered to be an integral part of each other (Sanoff, 2003). Robinson and Robinson (2009) affirm that the purpose of the designed environment is to provide a climate conducive to both teaching and learning. Studies have shown that an improperly designed physical environment in an educational institution may cause stress to occupants of the facility both directly and indirectly (Robinson & Robinson, 2009; Mutlaq, 2002; OECD, 2003; Sanoff, 2003). Thus, the trend is moving towards the consideration of other factors or dimensions in the physical environment which influence teachers and students in the educational process.

Heitor (2005) confirms that educational buildings are designed to make use of space as an educational tool regarding both the transmission of (socio-cultural, scientific and technical) knowledge and the promotion of learning capacity.

They represent the physical place to meet, search for information and study. Heitor (2005) states that empirical studies show that the performance of buildings impact on learning since they affect students and teachers performance and attitudes. Creating an effective school is a complicated issue. It entails designing the facility specifically as an educational environment. Accordingly, a well-designed building must support its users by addressing a broad spectrum of occupant related issues such as creating a physically comfortable environment with adequate lighting, temperature and noise control, technology and equipment and personal user-access needs. According to Sanoff (2003), these features address the requirements of the users of a particular space so that the classrooms work well for both lecturers and students.

To achieve this, the role of architecture is very crucial. In a recent study of selected educational buildings in Australia, Robinson and Robinson (2009) emphasize the role of architecture in creating a stimulating learning environment and community of excellence. Robinson and Robinson (2009) maintain that delivering a successful educational building entails a close collaborative relationship between the architect and all the key stakeholders from initial briefing through to the project handover. The brief should identify the opportunities and challenges to create an exciting architectural solution which is functional, aspirational and contextually responsible.

The design should demonstrate adaptability and flexibility, maintainability, attention to sitting, culture of community and sustainability. This means that learning, discussion and collaborative work spaces for groups of different sizes from lecture halls to small collaborative work spots must allow for flexibility in terms of extensibility, convertibility and versatility of use (Heitor, 2005). For example, instead of bearing walls that impede flexibility, the structural solutions should favour columns, light partition walls and wide spans. Simply put, it means the ability to make changes within the same space function in the building. The underlying question in the concept of educational building design is how the school's physical space (design product) should work to support educational goals (task) and at the same time ensure long term optimal use of the facility.

BUILDING PERFORMANCE INDICATORS

Performance evaluation is only part of a system developed over the years to assist managers in the translation of results into improved activity (Beatham, 2003). Within the construction industry, performance indicators are a collective term for performance measures. A key performance indicator (KPI) is simply indicative of a predictable outcome. For performance to be predictable, data must be benchmarked. If benchmarked data is not available, then decisions based on key performance indicators are only based on intuition. For example, when the temperature gauge on an engine reaches an unusually high level, the warning light comes on. This level has been set based on benchmarked data either through experience of use or through testing. This level shows an early indication of possible problems with the engine. The user therefore knows that action needs to be taken to prevent problems occurring. This explains why the KPI can only be indicative of future performance.

Performance indicators differ according to the nature and strategy of the organization. According to Alexander (2002:37) performance indicators are designed to reflect the business context in order to help the organization achieve its goals and strategic direction. For example, the performance indicators for an educational institution will differ from those of a bank or a manufacturing plant because they all reflect the operating environment of their respective businesses/operations. Furthermore, the performance indicators of a facility management organization in a commercial business are quite different from those of a public service.

Performance indicators are sometimes called key performance indicators because they measure key parts of the organizations' measurable objectives. A KPI must have a direction, benchmark, target and a time frame. They must reflect organizational goals no matter how they are selected because they are keys to the success of the organization (Then, 2004). Key performance indicators involve both quantitative and qualitative measurements. Quantitative indicators do not stand alone but are accompanied by appropriate commentaries which interpret the indicators in the right context. In buildings, there are several sources of performance indicators and these depend on the aspects of the building that are being evaluated.

In broad terms, Preiser (2002) identifies four primary criteria which occupiers/users look for in their buildings as location, quality, flexibility and cost effectiveness. Other design criteria/indicators include presentation, accessibility, space functionality, image, energy efficiency, fire safety and safety in use. Most of these criteria have also been identified and listed in ISO 6241 as contemporary guides or indicators to what makes a good building. Some of these indicators are qualitative while others are quantitative.

The qualitative ones are the intangible aspects of performance which are difficult to quantify in numerical terms because they are influenced by individual judgments, prejudices and other influences. The quantitative aspects are those that can be reduced (as much as possible) to measurement with numbers (Okolie, 2006). However, the indicators/measures used in both public service and private commercial service can be grouped into five broad categories, namely; economic, functional, physical, service and environmental indicators or measures (Then and Tan, 2002; Obiegbu, 2005). The explanation and purpose/objectives of these indicators are as follows:

- Economic indicators involve a combination of capital and revenue expenditure, rate of depreciation, investment value and contribution to productivity, profitability and efficiency. Economic indicators are concerned with decisions at strategic level which optimizes value for money. The objective of these indicators is to ensure optimum resource allocation, affordable and economic provision of resources according to market offerings and business plans.
- Functional indicators relate to the benefits that the buildings offer to the occupants/users. They are concerned with management decisions relating to the creation of the desired working environment according to organizational culture and workplace standards. For example, space (quantity and quality), layout, image, ergonomics, ambience, movement/communication, flexibility and adaptability. The objective of functional indicators is to ensure a continuous alignment of supply of appropriate functional space to anticipated service demands. Functional indicators also ensure fitness for purpose in meeting business requirements in terms of location and distribution, type, form and size of buildings.
- Physical indicators: These relate to the behaviour of the building in terms of finishes and envelope. They comprise physical properties such as deterioration, maintainability and durability.

Physical indicators are concerned with efficient and effective management of the operational aspects of the building facility. This is driven by the need to preserve the value of building and to ensure that the building condition does not lead to unnecessary operational risks and liability.

- Service indicators: These involve decisions and actions pertaining to quality perception by end users/occupiers. They are concerned with quality of service delivery by service providers. The objective of service indicators is to ensure that organizational culture within the context of business is adequately reflected in service delivery and in line with core business requirements. Measures or indicators in this category are usually subjective. They are derived from clients and end users' perception of support and organizational facilities. Service indicators comprise measures on building services efficiency such as air conditioning (air quality), lighting, energy and comfort.
- Environmental indicators: These are concerned with the role of buildings and their impact on the users, the community and the ecological environment. Indicators in this category include monitoring against prescribed sustainability targets at national, state, and project levels. They include issues such as environmental impact, health, safety and security.

METHODOLOGY

The study adopted the survey research approach using four Federal Government owned universities in the South Eastern part of Nigeria as case studies. To respect the anonymity of the institutions and for ethical reasons, the universities were referred to as universities A, B, C and D respectively. Staff of the universities holding key positions as construction professionals formed the study population. A simple random sample of twenty (20) professionals was randomly selected using a table of random numbers.

Data were collected using questionnaires and direct observations/walkthrough evaluations to provide information on the level of perception and practice of building performance evaluation in the institutions. Responses from the questionnaires and information retrieved from the walkthrough evaluations were analysed and results presented in tables, charts, mean scores and frequencies to address the research problem.

The hypotheses of the study were subjected to statistical test of proportion and analysed using MS Excel and statistica version 9.0.Given the reasonable response rate to the questionnaires, the findings and conclusions of the study may be deemed indicative of building performance evaluation practices and perception in South East Nigerian universities. Details of data analyses and findings are presented in Tables 1 to 5 and Figure 1.

FINDINGS

Table 1 shows the nature and type of building facilities in the targeted universities. The table reveals that most of the buildings provided and managed by the respondents were classroom or lecture buildings constituting about 39% of the building stock. This was followed by office buildings (24%) and residential buildings (10%). In the category of special buildings, the researcher found that they also manage such buildings as exhibition halls.

Table 1 Nature and types of buildings provided and managed by the universities

Target Universities	**Types of buildings**						
	*Res	Classroom	Office	Workshop/ warehouse	commercial	Recreational	Special buildings
University A	5	28	14	4	6	5	2
University B	8	24	18	5	6	8	5
University C	8	30	15	6	5	3	3
University D	3	10	9	3	3	1	0
Sub total	24	*92*	56	18	20	17	10
Grand total	237						
* Residential							

Source: (Researchers own creation, 2011)

The high percentage of classroom buildings in the table reflects the nature and distribution of building stock in the universities that were surveyed. The table further reveals that the respondents' focus was on providing and managing buildings owned and used by the universities.

Figure 1 is a pie chart showing the involvement of respondents in building performance evaluation exercises. The chart indicates that 70% of the respondents had no knowledge of building performance evaluation and so had not carried out any building evaluation exercises. Only about 30% of the respondents had knowledge of building performance evaluations.

This shows that majority of the respondents were not well informed about the performance evaluation process.

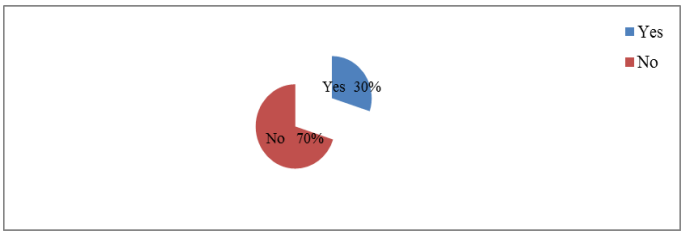

Figure 1 Involvement of respondents in building performance evaluation

Given the relatively high percentage of respondents (70%) with no knowledge of building performance evaluation, evaluations of critical performance indicators in buildings requiring specialised knowledge are never conducted (Table 2).

Table 2 Types of building evaluations conducted by the respondents

Types of evaluation	**Never**	**Not often**	**In 50% of cases**	**Often**	**Always**
	Response (%)				
Inspections	25.0	10.0	5.0	5.0	55.0
External observations	30.0	25.0	10.0	30.0	5.0
Interviews with users	40.0	30.0	5.0	20.0	5.0
Performance indicators	85.0	10.0	5.0	0.0	0.0
Manual measurements	30.0	20.0	15.0	25.0	10.0
Personal observations/walkthrough	30.0	15.0	10.0	40.0	5.0
Sustainability indicators	70.0	10.0	5.0	10.0	5.0

Source: (Researchers own creation, 2011)

The most common type of evaluation conducted by the respondents was inspections (55%). Walkthrough and personal observations were often conducted by the respondents (40%).The most likely explanation for the strong indication for inspections is the common tradition of technically inspecting buildings by facilities/building managers. In this study, these inspections are usually done at the beginning of academic sessions when new students/ users move in. Table 2 further shows that interviews with users were never conducted and this indicates absolute lack of interest in user satisfaction by the institutions.

Table 3 Barriers or reasons for not conducting building performance evaluations

Reasons	**Strongly disagree.....Strongly agree**					**Mean Score**	**Rank**
	1	2	3	4	5		
	Ranking (%)						
Insufficient expertise	10	35	10	5	85	4.45	1
Unwillingness to undertake evaluations/ lack of demand	5	10	0	30	55	4.20	2
No one is willing to pay	5	15	25	45	10	3.41	3
Value of evaluation is unclear	15	20	0	40	25	3.40	4
Ethical and personal barriers	10	5	0	0	40	3.30	5
Lack of responsibility	10	25	5	50	10	3.25	6
Poorly adapted evaluation methods	15	30	10	15	30	3.15	7
Lack of time and planning	20	35	10	5	30	2.75	8
Lack of evaluation methods	20	40	5	25	10	2.65	9
Evaluation methods are difficult to manage	20	50	0	10	20	2.64	10
Sensitive information	10	60	5	5	20	2.60	11

Source: (Researchers own creation, 2011)

In terms of the barriers or challenges to the practice of building performance evaluation in the target institutions, the respondents ranked insufficient expertise/funding (85% with a mean score of 4.45) as the greatest reason for not conducting the performance evaluation of buildings (see Table 3). The least reason given by the respondents for not conducting evaluations was sensitive information with a mean score of 2.60. The respondents strongly agreed that unwillingness to undertake evaluations/lack of demand (55 percent with a mean score of 4.2) was the second reason for the lack of evaluation exercise. The explanation for this may be that the users/occupiers do not know that they can demand it or that the facilities/building managers do not understand how they can utilize evaluations with users/occupiers. This is most likely because it appears the organisations neither understand the benefits of evaluation nor how it can help to determine the extent to which the users/occupiers' needs are satisfied by the buildings.

Table 4 Rating of performance aspects/measures by the respondents

Performance aspects of the building	**Adequate…….....Inadequate**				
	1	2	3	4	5
	Ratings (%)				
Fitness for purpose	2	2	9	29	58
Maintenance	1	7	10	23	59
Space needs met	1	1	23	35	40
Access to day light	8	13	26	40	13
Sanitary spaces	8	17	21	25	29
General accessibility	1	7	30	37	25
Fire safety	13	15	18	33	21
Furnishings	5	19	31	23	22

Source: (Researchers own creation, 2011)

Table 4 indicates that almost all the performance aspects were rated inadequate by the respondents. It is notable from the table that the most inadequate aspect of building performance is maintenance; rated 59%. This was followed by fitness for purpose and space needs (58% and 40% respectively). This implies that the interaction between users and buildings in the universities do not add value to learning and working experiences.

HYPOTHESES

Two hypotheses were postulated for the study and stated in Null (Ho) and Alternative (H1) forms respectively. The hypotheses were formulated to shed light on the key areas of the study from which data were obtained and analysed. Test of proportion was used to evaluate the statistical significance of findings from the field data. The choice of this tool was guided by the recommendations in Agresti and Franklin (2007) that test of proportions can be used for categorical variables (correct and incorrect predictions). Thus:

Hypothesis 1:

- H0: The level of perception and awareness of building performance evaluation is high and does not impact significantly on building improvement policies in educational institutions.
- H1: The level of perception and awareness of building performance evaluation is low and impacts significantly on building improvement policies in educational institutions.

Hypothesis 2:

- H0: The approach to funding of building performance evaluation is not below best practice standards in educational institutions.
- H1: The approach to funding of building performance evaluation is below best practice standards in educational institutions.

Hypothesis 3

- H0: Building facilities that are not fit for purpose do not impact negatively on teaching and acquisition of key competences in educational institutions.
- H1: Building facilities that are not fit for purpose impact negatively on teaching and acquisition of key competences in educational institutions.

In testing the above hypotheses, the results of the empirical investigations were analysed using Excel and statistica version 9.0 software packages. The results are presented in Table 5.

Table 5 Respondents' perception and practice of building performance (N = 20)

Hypothetical Statements (H1)	***SD .....SA**					**M**	**P**	**TS**	**CV**
	1	2	3	4	5				
	Rank (in percent)								
Level of perception and awareness of building performance evaluation is low and impacts significantly on building improvement policies.	0	10	5	25	60	4.35	0.850	2.28	1.65
Funding of building performance evaluation is below best practice standards	0	0	5	70	25	4.20	0.950	3.20	1.65
Building facilities that are not fit for purpose impact negatively on teaching and acquisition of key competencies	0	10	0	60	30	4.10	0.900	2.74	1.65

*SD = Strongly Disagree; 2 = Disagree; 3 = Neutral; 4 = Agree; SA = Strongly Agree; P = Sample proportion; M = Mean; TS = Test Statistic; CV = Critical Value

Source: (Researchers own creation, 2011)

The test statistic is given by $\mathbf{Z = P–Po/\sqrt{Po\,(1–Po)/n}}$.

Where P = sample proportion; Po = null hypothesised proportion value and n = sample size.In this case, the sample size n = 20 and the null hypothesised value Po = 0.6. This gives 12. That is, 20 (0.6). This is close to the condition of normality (successes and failures ≥ 15) but this value was considered adequate for the test due to the exploratory nature of the study.

Hypothesis 1 can therefore be restated as follows:
H0: $P \leq 0.6$
H1: $P > 0.6$

This is a one tail or one sided test. The test statistic is given as Z=2.28 (see Table 5).
Decision Rule: Reject Ho if $Z \geq Z1\text{-}\alpha$. Where Z=the test statistic, $\alpha = 0.05$ (at 5% level of significance) and $Z1\text{-}\alpha$ = the critical value. But in this analysis, $Z1\text{-}\alpha$ is given as 1.65 (the critical value) at 5 percent level of significance and the null hypothesised proportion value Po = 0.6 which is 60% as earlier stated.

Conclusion: Since Z = 2.28 is greater than 1.65. This indicates that the evidence is statistically significant and so the null hypothesis is rejected and in favour of the alternative hypothesis. That is; the level of perception and awareness of building performance evaluation is low and impacts significantly on building improvement policies in educational institutions.

Similarly, hypothesis 2 is given as:
Ho: $P \geq 0.6$
H1: $P < 0.6$

This is also a one sided test and using the Excel software package for the calculations, the test statistic yielded Z = 3.20 (see Table 5).
Decision Rule: Reject Ho if $Z \geq 1.65$ (the critical value) at 5 percent level of significance

Conclusion: Since Z = 3.20 is greater than 1.65, the evidence here is statistically significant. The null hypothesis is hereby rejected and in favour of the alternative hypothesis. This implies that a significant proportion of respondents support the claim that approach to funding of building performance evaluation is below best practice standards in educational institutions.

Again, hypothesis 3 is stated as:
Ho: $P \leq 0.6$
H1: $P > 0.6$

This again is a one tail or sided test and using the Excel software package for the calculations, the test statistic yielded Z = 2.74 (see Table 5).

Decision Rule: Reject H0 if $Z \geq 1.65$ (the critical value) at 5 percent level of significance
Conclusion: Since Z = 2.74 is greater than 1.65, the evidence is statistically significant and so the null hypothesis is rejected and in favour of the alternative hypothesis. This means that building facilities that are not fit for purpose impact negatively on teaching and acquisition of key competences in educational institutions. Again, this is supported by a significant proportion of respondents in the investigation.

The results of the hypotheses tested in this study show that all the hypothetical statements were supported. The hypotheses were developed and tested with data obtained from all the case organisations because there were no significant contextual differences in the study setting.

SUMMARY AND DISCUSSION

The analyses and results of data presented in this study reveal apparent lack of a systematic mechanism for measuring the success of completed and occupied buildings in the case organisations. This supports the views of Amaratunga and Baldry (2000) that performance evaluation of buildings is not a mainstream activity in Africa. The empirical investigations as indicated in Table 4 show that most buildings perform poorly in terms of maintenance and fitness for purpose.

The implication is that the interaction between users and buildings did not add value to learning and working experiences. The result of the alternative hypothesis 3 in the investigation validates this conclusion.

The challenge of inadequate funding and absence of performance evaluation database and standards in the institutions further compounds the performance evaluation process in the institutions. Hypotheses 1, 2 and Table 3 support this assertion. The building facilities units/ departments in the case organisations appear to be satisfied with the status quo and are contented with the adoption of reactive rather than proactive response to service delivery and demand. This was reflected in Table 2 of the analysis. The analysis in Table 3 further establishes absolute lack of interest in building performance evaluation by management and the inability of physical planning/building units of the case organisations to integrate their functions with that of the core business of the institutions.

CONCLUSION AND RECOMMENDATIONS

This study has provided a clear understanding of the concept of educational building design and effective performance evaluation process. It captured the critical performance indicators/variables (economic, functional, physical, service and environmental indicators) for an effective building performance evaluation exercise. The study forms the mirror image of the extent to which educational buildings meet the needs of the user and building performance evaluation practices in the chosen context. The case studies point to the need for a building performance evaluation system that produces not only buildings that support educational objectives but also buildings in which users or occupants are comfortable and productive.

Generally, the findings in the study show that a significant number of buildings in all the institutions are not fit for purpose. Respondents rarely measure aspects of the buildings' physical performance. When they do, it is done in the form of technical inspections, walkthroughs and informal complaints. This indicates that the universities are yet to transit from the technical approach of managing buildings to the one in which users' needs are supported by the functional effectiveness of the buildings.

This situation exists due to poor perception and knowledge of building performance evaluation as a tool for the effective management of educational buildings in the institutions. The poor level of perception in this knowledge area shows that the terrain is largely unexplored. In view of the findings discussed in section 5.0, it is recommended that Performance evaluation of buildings in Nigerian universities be given substantial attention to address the issue of poor building performance, low perception and awareness of this tool for organisational effectiveness. Facilities managers and other building service consultants should create the awareness by informing top management of the importance of building performance evaluation and its role in supporting the core business of the university system.

Government should create the enabling environment by providing adequate funding for the procurement of building infrastructure in the university system. Government should also make it mandatory for university management to evaluate the performance of their existing buildings on a regular basis. The evaluation system should adopt appropriate strategies such as benchmarking against other institutions for best practices. Finally, well qualified and experienced building performance evaluation staff should be appointed to prepare evaluation plans, schedule of building performance aspects and well-motivated performance evaluation budgets for the institutions.

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