Performance Evaluation of Buildings in Educational Institutions: A Case of Universities in South-East Nigeria

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by

Kevin Chuks Okolie
Student Number 209080216

Promoter: Professor Winston Shakantu

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Abstract

Buildings constitute a substantial percentage of most educational institutions' assets, user needs and operating costs. The performance level of this resource is therefore very critical to educational effectiveness. However, despite the crucial role of this resource in the education and construction sectors of the economy, evaluation of building performance is not a mainstream activity in Africa, particularly Nigeria. Presently, there is limited or no research/data in Nigeria to assess how extensively the use of or lack of building performance evaluation techniques affect teaching, learning spaces and overall organisational performance. The aim of this research was to develop an appropriate model for building performance evaluation in higher education institutions based on performance indicators, for improved awareness, understanding and practice. The research primarily focused on 'user needs/requirements' within the organisational context. The methodology employed in the study included a review of the relevant literature and multiple case-studies conducted on four Federal Government universities in South East Nigeria. The target universities constituted the units of analyses and therefore provided opportunity for in-depth examination of the links between users, building facilities and organisational processes as established in the literature review. Epistemologically, the research is objectivist and paradigmically positivist. However, some qualitative aspects of data were relevant to the study and therefore used in a complementary manner. The case approach utilized mixed methods by applying a range of data collection techniques and evidence from multiple sources. The sampling technique was sequential involving both purposive and stratified random sampling. The study reveals apparent lack of a systematic mechanism for evaluating the success or performance of completed and occupied buildings and so the interaction between users and buildings did not add value to learning and working experiences in the target institutions. The bespoke methodology and conceptual process model developed in this research constitute an innovative and pioneering contribution to building performance evaluation as a developing field of knowledge. The study has established a basic level of awareness and understanding among construction practitioners that building performance evaluation can be used as a tool for delivering strategic objectives in the management of educational buildings. The study strongly advocates the inclusion of building performance evaluation as part of the building procurement process. The proposed model in the study provides a useful guide needed by the institutions to navigate to future competitive success in higher education built asset/facilities management.

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Declaration

This thesis is submitted under the Nelson Mandela Metropolitan University regulations for the award of a PhD degree by research. I, Kevin Chuks Okolie with student number 209080216 hereby declare that this thesis is original and that no portion of it has been submitted in support of any application for another degree to any other university or institute of learning.

Signed:.....

Date:.....

Definitions of terms

Accessibility: A determination of the capability of a facility to permit handicapped personnel/students to enter and use the building (Lackney, 2001).

Adaptability: In building, the ability to make suitable for a particular purpose by means of change or modification (Worthy, 1995)

Added Value: Tangible gain from a decision, action or procedure that exceeds its monetary equivalent. For example, service performed at its most economical cost and yet provides further benefit from, say, the manner in which other needs of the customer or user are satisfied (Atkin and Brooks, 2005).

As-built drawings: A set of drawings that show the building as it was actually built; all changes made during the construction period should be included in such a drawing (Worthy, 1995).

Building facilities: This refers to buildings specifically designed and used for learning and other educational purposes (Then, 2004).

Building Users: These refer to all people with an interest in a building including staff, students, managers, customers, clients, design and maintenance teams and particular interest groups such as the disabled (Lackney, 2001).

Building: A structure enclosing space for the purpose of carrying out specific programs or operations (Worthy, 1995).

Direct Observation: A method where data is collected by direct contact with real life situations and by behaviours that occur naturally (Sanoff, 2003).

Dutch disease: This refers to the deindustrialization of a nation's economy which occurs when the discovery of a natural resource raises the value of that nation's currency; making manufactured goods less competitive with other nations, increasing import and decreasing exports (www.investorwords.com/1604/dutch_disease).

Educational Institutions: Educational institutions in the context of this study refers to Higher educational institutions; particularly, universities in the study area (Okolie and Shakantu, 2009b).

Evaluation: Assessment of value; the act of considering or examining something in order to judge its value, quality, importance, extent or condition (Atkin and Brookes, 2003).

Facilities management: This is an umbrella term under which a wide range of property and user related functions may be brought together for the benefit of the organization and its employees as a whole (Spedding, 1994:8).

Facility Condition Index: An indicator of potential shortcomings of the useful life of facilities and likely increase in long term maintenance and repair cost (Then, 2004).

Facility: This is something designed or created to provide service or fulfil a function. It is often used as plural (Atkin and Brookes, 2005). In this context, they refer to buildings designed for educational purposes.

Initial Cost: This is the capital or initial expenditure on an asset when first provided (Nwosu, 2007).

Interview: This is a method used to assess people's reactions to physical settings. It can be structured, where the type and order of questions are decided in advance or unstructured where the interviewer asks questions of interest while visiting a site (Sanoff, 2003).

Life cycle costing: This is defined as an assessment of competing design alternatives considering all significant costs of ownership over the economic life of each alternative expressed in equivalent monetary terms (Nwosu, 2007).

Life Cycle Costs: The total cost of a system, building or other products computed over its economic life. It includes all relevant costs involved in acquiring, owning, operating and disposing the system or product over a specific period of time including environmental facilities cost (Nwosu, 2007).

Post Completion Review: A systematic and rigorous process of comparing the actual performance of the project outcome with the stated objectives of the original brief (Preiser, 1995). The process seeks to identify ways in which future project conception, design development and implementation can be improved.

Post Implementation Review: A comprehensive feedback mechanism designed to assess project outcomes. This assessment focuses on how well the project outcomes were matched to the actual needs that the project is aimed to fulfil (Preiser, 1995).

Simulation: This is a method evoking people's comments from representations of settings rather than from the settings themselves (Barrett and Baldry, 2003).

Stakeholders: These refer to staff, students, clients/owners, design and construction team, members of the community, facility and maintenance managers (Lackney, 2001).

Value chain: A chain of activities through which the products of an organization pass in order to gain or add value. It is a generic value adding activity of an organization where cost and value drivers are identified for each value activity (Groome, 2009).

Abbreviations used in the study

ASTM: American Society for Testing and Materials

BPE: Building Performance Evaluation.

BP: Best Practice.

BSI: British Standard Institute

BS: British Standards.

CABE: Commission for Architecture and the Built Environment.

CIB: International Council for Building

CELE: Centre for Effective Learning Environment.

FFC: Federal Facilities Council.

FPE: Facility Performance Evaluation

FRN: Federal Republic of Nigeria

H: Hypothesis

HVAC: Heating, Ventilation and Air Conditioning.

ISO: International Standard Organization

IFMA: International Facility Management Association.

MARU: Medial Architecture Research Unit.

NBI: New Buildings Institute.

NIBS: National Institute of Building Sciences.

NUC: Nigerian National Universities Commission.

OECD: Organization for Economic Co-operation and Development.

POE: Post Occupancy Evaluation

PDE: Pre-Design Evaluation

PEB: Program on Educational Buildings.

PCR: Post Completion Review.

PIR: Post Implementation Review.

RIBA: Royal Institute of British Architects

RILEM: International Union of Laboratories and Experts in Construction Materials, Systems and Structures

S-p: Statement of Sub-problems.

SBS: Sick Building Syndrome

UNESCO: United Nations Educational, Scientific and Cultural Organization.

WBDG: Whole Building Design Group.

Dedication

This thesis is dedicated to my wife Late Barrister (Mrs.) Olachi Azuoma Okolie (November 2010) and my parents:

- Late Chief Stephen Okolie (February 1999); and
- Late Mrs. Evelyn Okolie (February 2009)

Chapter 1: The Problem and its Setting

1.1 Introduction

Buildings are systemic; they have many interacting systems and subsystems both as part of the physical infrastructure and how human activity is organized within and in relation to them. They also have clear hierarchic properties in which constraints and decisions are handed down from one layer to the other. The constraints and decisions come from different professions such as architecture, engineering, valuation and planning operating at different levels in the hierarchy (Leaman, 2004:15). For example, planning decisions which constrain the building envelope, valuation advice which constrains the budget, architectural design decisions which set the context for services (often with little or no dialogue about the engineering implications) and engineering decisions expected to be taken within the constraints passed down. At the bottom of the hierarchy is the user, who lives with the consequences of all these decisions (Leaman, 2004:18). Architects, planners and consultants may come and go, but users spend their lives in the creations of these designers. Barrett and Baldry (2003:94) observe that very few organizations ask their staff whether a building meets their requirements; even-though the people that understand a building best are the people that use it. In most cases, the people concerned and affected by the design are never involved or considered in the design process. Design and decision-making is rather concentrated, fragmented and involves only a small group of experts (Danny, 2003: 282). This process sees many consultants working in isolation, resulting into inadequate briefs, with many variables that have considerable and sometimes significant effects on their designs.

It is generally known that organizations simply identify their need to build and go through the process of planning, briefing, design, construction and final occupancy. This process is linear and usually repeated for every new building project that the organization may undertake (Barrett and Baldry, 2003:93-104). Although this is the typical process, it is not necessarily the best because it creates a lacuna in the building delivery process. Absence of evaluation does not allow organizations to make use of feedback from their staff (users); a valuable resource at their disposal. This gap limits the opportunity to learn from the staff how well the building is performing in terms of user needs. Data and information from evaluation can be used as a feed-back/feed-forward into designs for new buildings or improvement of existing

ones (Preiser, 1995). Buys (2004:47) notes that feedback should be obtained from occupants who have the closest experience of building needs and maintenance requirements. Feedback from users occupying completed buildings can help not only to fine-tune the building and inform the client but also inform the design and building team on the effectiveness of building operations. This shows that there is a nexus between design brief, evaluation and feedback. Evaluation and feedback provide the necessary information for good briefing, which in turn contributes to high building performance and overall organizational effectiveness. Unfortunately, as Leaman (2004:19) observes, feedback is not well used because most designers and builders tend to be territorial in defending their perceived areas of expertise and often go on to the next project without learning from the one they have just done. Evaluation of buildings provides opportunity for organizations to see how well a particular building facility meets their requirements. For long term strategic planning, evaluation of buildings provides information about what kinds of buildings will be needed in the future to accommodate the organizations' expected development (Barrett and Baldry, 2003:97-99). Information or knowledge of buildings that are performing poorly and those that are performing well helps organizations in the consideration of long term strategic plans. Furthermore, operational and maintenance decisions can benefit from building performance data.

1.1.1 Evaluation of buildings in educational institutions

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, 2000:294). 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, 2000:297). To date, little data is available in Africa to assess how extensively the use of the technique has diffused educational institutions, how it affects teaching spaces and overall organizational performance (Amaratunga and Baldry, 2000:295; Mutlaq, 2002:15; Zimring and Rashidi, 2008).

Leaman (2004) reports that the reason for this is because academic disciplines do not regard building performance as an area of legitimate interest. It seems too trivial and at the same time too difficult. It is also interdisciplinary and so does not fit well into career paths and funding stereotypes.

Nevertheless, studies have shown that buildings represent a substantial percentage of most educational institutions' assets, operating costs and user requirements; their performance level is therefore very critical to educational effectiveness (Douglas, 1996; Amaratunga and Baldry, 2000:293-301; Sanoff, 2003:4). Educational buildings are designed and built to meet specific or group of needs already determined to a large extent before implementation. In educational institutions, buildings constitute the essential concrete features that enable the teacher to teach effectively. This implies that it is a major resource which can be manipulated to cause learning to occur. The ability of the building to successfully accomplish the purpose for which it is designed measures its success (Mayaki, 2005:4). In this regard, educational buildings are designed to make use of space as an educational tool for the transmission of knowledge and the promotion of learning capacity. Sanoff (2003:8) maintains that the design of modern educational buildings strongly emphasizes stimulating and adaptable learning environments with spaces that support various styles of teaching and learning. This implies ability to make changes within the same space function in the buildings.

It is true that change is a constant phenomenon and for educational institutions, especially universities, the future is not totally predictable. The pace of change affecting buildings primarily through technological and economic influences is likely to increase rather than slow down (Weller, 1995:12). This confirms the view of Belcher (1997) that some of the potential implications of change for universities are proliferation and diversity of technology, adaptation of shared facilities (use of common teaching spaces and laboratories) and greater emphasis on quality in the study place. It is necessary for building facilities to respond to the challenge of changing needs and demand in a knowledge economy (OECD, 2006). The dynamics of the education sector makes it compelling for constant and periodic change and this calls for proactive and strategic planning. Universities have a responsibility to provide educational opportunities through well-developed curricula that aid students to obtain academic and professional competencies. This depends on students being supported and not frustrated by inadequate building facilities or dysfunctional built asset environment. Classroom communication for example, requires certain acoustic, visual and physical

conditions; and feedback from efficient design is essential for improving future designs (OECD, 2003). Building performance evaluation helps to ascertain if organizations are managing existing building stock responsibly. By understanding how existing buildings affect occupants, designers can minimize problems and capitalize on successful design features which improve system performance.

1.1.2 The state of building facilities and learning environments in Nigerian universities

The university is the highest level of schooling. Its environment must therefore be accorded the highest premium for effective functioning and productivity. There is evidence to support the assertion that inadequate funding of physical facilities, particularly buildings, has led to unproductive learning environments in the Nigerian university system. Ojogwu and Alutu (2009:8) in their study on infrastructural facilities in Nigerian universities state that the rapid expansion and the resultant proliferation of courses in universities without sufficient regard to resource constraints and limited executive capacity have placed a large burden on the universities. The learning environment is unhealthy with decayed and dilapidated infrastructural facilities. This seriously undermines the goals and objectives of national policy on education. The reasons for this state of affairs, according to Ojogwu and Alutu (2009) are mismanagement of funds, lack of a mixed maintenance culture and explosion in student enrolment.

Ojogwu and Alutu (2009:10) further state that physical facilities, in over 90 percent of the institutions of higher learning in Nigeria are appalling. At the University of Benin, for example, the space provided for most departments is grossly inadequate for lectures or practicals; some lecturers have no offices, the classroom spaces are small and do not permit meaningful interaction between the teacher and the students. The National Universities Commission (NUC) (1989) prescribes a minimum of twenty one (21) lecture theatres with a capacity to sit between one thousand (1000) to two thousand (2000) students at once. The present situation in the university is a far cry from the minimum requirement of NUC. Consequently, Ojogwu and Alutu (2009) lament that students and teachers have become disinterested and apathetic to the goals of learning.

A clear message emerging from Ojogwu and Alutu's (2009) studies is that physical facilities impact significantly on educational effectiveness. It also shows that effective and efficient

management and use of the property resource is imperative for all universities. University management must therefore recognize the strategic importance of facilities management.

From the foregoing, it is clear that one of the challenges facing Nigerian universities is the massive expansion in higher education participation and the explosion in yearly students' in-take. As a result of this, the physical facilities/built asset requirements (offices, space requirements of classrooms, lecture theatres, parking spaces, hostels, laboratories and workshops) are hardly met. Confirming this situation, Okebukola (2002:12) reports that facilities are overstretched, thus presenting a recipe for rapid decay in the face of dwindling funds for maintenance. This research seeks to identify the critical performance evaluation 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. The study therefore takes a holistic evaluation of the built asset environment, including administrative and support facilities/buildings in the institutions under investigation. In a clear statement, the research problem is formulated and presented in the coming sections.

1.2 Problem formulation

The key issues in building performance evaluation are efficiency and productivity. The fact that a design brief must state how the building should perform for the user explains these key issues. But the question is "how well does the building actually work?" At least, three basic perspectives must be considered in this respect:

- Users, and how well their needs/requirements are met;
- Environmental performance in terms of energy use and water efficiency; and
- Whether the building adds value or makes economic sense.

Unfortunately, most modern buildings fail in all three categories (Standeven, Cohen, Bordass and Leaman, 1998). Leaman, Stevenson and Bordass (2010:265) support this view and report that many of the buildings perform so poorly that people are embarrassed to publish the results. As a result, designers and managers do not learn from past mistakes. Earlier, in his studies on the performance of buildings, Leaman (2004) reports that buildings do not work as well as they should for their owners. Leaman (2004) maintains that buildings surveyed in the

United Kingdom show a building-related productivity loss of 2% on the average. Leaman's (2004) report further shows that actual energy consumptions in buildings are very much higher than design predictions due to poor feedback loop.

In Nigeria, the situation is not better. The perception and awareness is even lower because there is a limited amount of research in building performance evaluation. This is probably because the concept is still a new field of expertise and so most buildings particularly, educational buildings often fail to meet the needs of the educational process and rarely provide the best value for users(Udida, 2008). Udida (2008) maintains that inadequate funding and investment in physical facilities, research, training and development has diminished the contribution of the construction sector to educational effectiveness in Nigeria.

The recent expansion in higher education participation in Nigeria has exposed the functional inadequacies of educational buildings and therefore poses a tremendous challenge to the university system in terms of academic capacities, building infrastructure, funding and environmental concerns. Since buildings form a significant part of infrastructural facilities in the university system, this challenge calls for effective facilities management skills to improve the value of constructed buildings. Modern trends in teaching and learning demand a paradigm shift from staff teaching to student learning. However, this cannot be achieved in an environment with dysfunctional building facilities (Ojogwu and Alutu, 2009).

Building performance evaluation therefore provides organizations with an effective and holistic tool for proactive building facilities management and improvement. It evaluates the physical aspects of buildings with respect to design and user objectives. Currently, the concept of building performance evaluation is little understood and therefore not well established among construction professionals in the 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 educational building facilities management.

1.3 The statement of problem

Most educational institutions in Nigeria do not regard building performance evaluation as an area of legitimate interest; do not lay emphasis on the user-value of buildings and therefore procure buildings that are not adaptable, flexible and fit for purpose.

The next two sections introduce the sub-problems related to the statement of problem and link each of the sub-problems to a hypothesis that the research will test in section 5.4.

1.4Statement of Sub-problems (S-P's)

S-p 1: Educational institutions do not lay emphasis on performance and user-value in the procurement of building facilities.

S-p 2: Building performance evaluation in educational institutions appears too trivial and does not fit into building procurement and funding stereotypes.

S-p 3: A significant number of building facilities in educational institutions are not fit for purpose.

S-p 4: Critical performance indicators/mandates are often absent in the design, construction and management of buildings in educational institutions

S-p 5: Building facilities in educational institutions are overstretched and inadequate for effective learning and teaching.

S-p 6: There are no feedback mechanisms in the design and management of buildings in educational institutions.

S-p 7: Building facilities in educational institutions are not adaptable and flexible.

S-p 8: There is low perception and awareness of building performance evaluation among stakeholders in educational institutions.

1.5 Hypotheses

H1.1: Emphasis on building performance and user-value enhances design and organizational effectiveness in educational institutions**.**

H2.2: The approach to funding of building performance evaluation in educational institutions is below best practice standards.

H3.3: Building facilities that are not fit for purpose impact negatively on teaching and acquisition of key competences in educational institutions.

H4.4: Building facilities which lack critical performance indicators/mandates in their design impact significantly on user satisfaction in educational institutions.

H5.5: Inadequate building facilities and spaces for learning and teaching affect academic performance in educational institutions.

H6.6: The lack of effective feedback mechanism results in poor design and procurement of unsuitable buildings in educational institutions.

H7.7: Buildings that are not adaptable and flexible do not respond to the demands of changing needs in educational institutions.

H8.8: The level of perception and awareness of building performance evaluation is low and impacts significantly on building improvement policies in educational institutions.

The problem statements and hypothesis are not mutually exclusive but inextricably related in the development and validation of the research. Table 1.1 shows a summary of the relationships of the sub-problems with the research hypothesis

Table1.1: Relationships of sub-problems with research hypothesis

Statement of Sub-problems (S-p)	Corresponding Hypothesis (H)
Sub-problem 1 (S-p 1)	Hypothesis 1 (H1.1)
Sub-problem 2 (S-p 2)	Hypothesis 2 (H2.2)
Sub-problem 3 (S-p 3)	Hypothesis 3 (H3.3)
Sub-problem 4 (S-p 4)	Hypothesis 4 (H4.4)
Sub-problem 5 (S-p 5)	Hypothesis 5 (H5.5)
Sub-problem 6 (S-p 6)	Hypothesis 6 (H6.6)
Sub-problem 7 (S-p 7)	Hypothesis 7 (H7.7)
Sub-problem 8 (S-p 8)	Hypothesis 8 (H8.8)

1.6 Research aim and objectives

The major aim of this research was to develop an appropriate model for building performance evaluation in higher education institutions based on key performance indicators; for improved awareness, understanding and practice. In this regard, the following represent the specific objectives of the study which were to:

- Utilise the performance concept to identify the key performance indicators in educational buildings;
- Appraise the nature and type of building facilities in the targeted universities;

- Determine the suitability of the buildings and establish the extent to which they enhance both educational and operational effectiveness;
- Identify and resolve major space and evaluation/environmental problems in the existing building facilities of the targeted universities; and
- Develop a performance evaluation model that would incorporate best practices in educational buildings.

However, it was not the intention of this study to test or validate the proposed model due to the methodology of the research.

1.7 Justification for the Study

Building Performance Evaluation is still a developing field of knowledge and expertise. There is a great need therefore for research that provides an objective assessment of the performance of buildings especially in educational institutions. In recent times, educational institutions are getting fewer subsidies from the government. This calls for proactive facilities management strategies in these institutions. Inadequate facilities, such as buildings and equipment in educational institutions affect not only the number of students attracted each year but also the academic standards of the institutions. In Nigeria, stakeholders have continuously expressed concern over the appropriateness or suitability of educational buildings especially in the universities; buildings often fail to meet the needs of educational process and rarely provide the best value for users. Investment in physical facilities, research, training and development is too little and therefore diminishes the contribution of the construction sector to innovations in technology and educational effectiveness (Udida, 2008:12). Besides, public perception of evaluation is very low and building performance is widely seen as unpredictable in terms of user expectation and quality standards (Nwosu, 2007:6; Obaka, 2008:20).

Although there is an understanding among designers and other stakeholders in education that there is a nexus between buildings in educational institutions and the academic performance of students, there is little or no specific research on how, and to what extent the performance of buildings influence the academic performance of students in Nigeria. In other words, there have been relatively few or no detailed studies on this issue. These concerns provide the basis or rationale for the study and the findings will therefore increase the awareness and public

perception of building performance evaluation as a key business driver. The study helps to identify appropriate performance evaluation methodology and factors that affect the performance of buildings. It also ranks the performance indicators that most contribute to the realization of educational objectives of universities. Again, since knowledge in this area is not yet adequate, the findings will provide the universities with the instrument needed to navigate to future competitive success and contribute to knowledge in this area of study.

1.8 Research methodology outline

The methodology for this research is structured around the performance evaluation of buildings with a focus on the user. The study therefore attempts to determine the extent to which user needs were met with respect to some identified design /performance measures within the target organisations. In this context, the outline of the study methodology includes:

- In-depth examination of the country and study context;
- A descriptive understanding of building performance evaluation constructs and related concepts;
- Identification of performance evaluation measures and user needs in the educational setting;
- General level of building performance evaluation practices and types of building stock in the target institutions;
- The extent to which users/ stakeholders' needs were satisfied or met in the target institutions.

The research adopted the case study approach with a mixed method of data collection. The mixed method involved both qualitative and quantitative data sets. The main instruments of data collection were interviews, focus group discussions, questionnaires, reviews, walkthroughs, observations, audio tapes and photographs. The case study involved the analysis of building performance evaluation practices of four (4) universities in South East Nigeria to determine the extent to which the performance of their buildings satisfies or meets the needs of the users or stakeholders. Evaluation of the case studies started with a descriptive approach, identifying the mission, characteristics and types of building facilities management functions carried out by the institutions. This was followed by the qualitative and quantitative analysis of data from the study. Based on the findings of the study, a conceptual graphical model was proposed to guide management in taking decisions concerning the improvement

of building performance in educational institutions. The role of the quantitative data throughout this research is to support the qualitative findings. A framework for the effective performance evaluation of buildings is also included.

1.9 Delimitation of the scope of the study.

The study is limited to the performance evaluation of buildings in government owned universities in South Eastern Nigeria. According to the Federal Ministry of Education (FME), there are nine of such universities in that geo-political zone; four are owned by the Federal Government of Nigeria and five by the state governments. These universities are located in the five states that make up the geo-political zone as shown in Table 1.2. The study concentrates on the four universities owned by the Federal Government as units of analysis. For purposes of confidentiality and anonymity, the universities are labelled A, B, C and D respectively as shown in Table 1.2. The study evaluates specific aspects of planning and detailed design and matches performance against design expectations within the ambits of budget for capital projects of the targeted universities.

The design expectations are evaluated in terms of function/purpose, accessibility, economy, aesthetics, experience and environmental quality. These performance variables are predicated upon identified international design principles/criteria for educational buildings and are regarded as standard performance mandates for the evaluation process. The performance mandates are evaluated against existing and observed institutional standards, user requirements and procurement practices. Accordingly, the study does not evaluate the engineering and technical performance of buildings which include structural stability, integration and robustness of systems, fire safety, heating systems and new building materials.

Table 1.2: Federal Government owned universities in the South East Nigeria.

Serial Number	Name	State/Location
1	University A	Enugu
2	University B	Anambra
3	University C	Imo
4	University D	Abia

Source**:** Federal Ministry of Education (2009).

The buildings are considered only in terms of their effect on the occupants/users. Building performance evaluation, particularly, educational buildings and teaching spaces with at least twelve (12) months of occupation in their life cycle were considered in the four (4) targeted universities. Other forms of building facilities outside this were not considered. The results of the research are based on information provided by the above institutions and conclusions are drawn from them.

1.10 Key assumptions of the Study

Assumptions are conditions that are taken for granted. They are therefore accepted as true without proof (Leedy and Ormrod, 2010:5).

In relation to the sub-problems, the following assumptions provide a direction to the understanding of the study as conceptualized;

- Performance indicators or measures impact on the design and management of buildings;
- Buildings are major facilities and therefore constitute an educational tool;
- Financial resources for design and procurement of buildings will always be limited;
- The current views of facility managers regarding performance indicators for best practice will continue to be relevant now and in the foreseeable future;
- The respondents are well informed and experienced enough to give authoritative feedback on the information sought;
- There is a misplaced faith in design, technology, management and lack of positive synergy for strategic thinking among stakeholders in the construction industry; and
- Design, maintenance and operational effectiveness of buildings in educational institutions must be considered as factors that positively contribute to learning and working for both staff and students.

1.11 Structure of the thesis

This thesis is structured into 6 chapters. **Chapter 1** begins with a section introducing the research setting, problems and sub problems. It describes the general state of building facilities, evaluation and learning environments in developing countries; particularly, Nigeria. The chapter then introduces the formulation of the problem, the statement of the problem and sub-problems and the associated hypotheses. These are followed by a discussion of the research aim, objectives, justification and outline of the methodology. The chapter concludes

with a delimitation of the scope of the study, the key assumptions and structure of the thesis. A graphical representation of the thesis structure is shown in Figure 1.1.

Chapter 2 comprises of two sections that present the country context of the study and a review of academic literature on building performance evaluation. The section on country context presents the political, economic and socio-cultural contexts of Nigeria a well as the characteristics of the study setting. The section concludes with a description of the construction industry in Nigeria, the education sector and challenges of the university system. The general academic review evaluates the current level of understanding in the design and evaluation of educational buildings; key building performance evaluation aspects and best practices, facilities management and implications to educational effectiveness. This chapter ends with a wrap-up of the key research problems to be addressed by the study.

Chapter 3 introduces the theoretical basis of the research which is anchored on the concept of performance. The chapter further evaluates the underlying concepts of building performance evaluation, facilities and value management within the context of construction management. This chapter concludes by re-stating the aim and objectives of the study and further establishes why the problems identified in the research exist.

Chapter 4 describes the methodology adopted for the conduct of the research and the underlying concepts for the choice of research instruments. The chapter evaluates the various philosophical constructs and research paradigms and then justifies this research's philosophical position and methodology. The chapter concludes by describing the research design/strategy, data collection instruments and consequent validity.

Chapter 5 presents an analysis of the four (4) case study organisations in the South Eastern part of Nigeria. The case-studies are presented and discussed from the view-point of institutional stakeholders and the general environment within which the evaluation of building performance takes place. The chapter further presents data, analyses and discussions of research results including the test of hypotheses. This is followed by the development of a conceptual graphical performance evaluation model based on the balanced scorecard and research findings.

Chapter 6 presents an overview of the research, the summary of findings, conclusions and recommendations. Consideration is also given to the research limitations, contribution to knowledge and areas for further research on this topic.

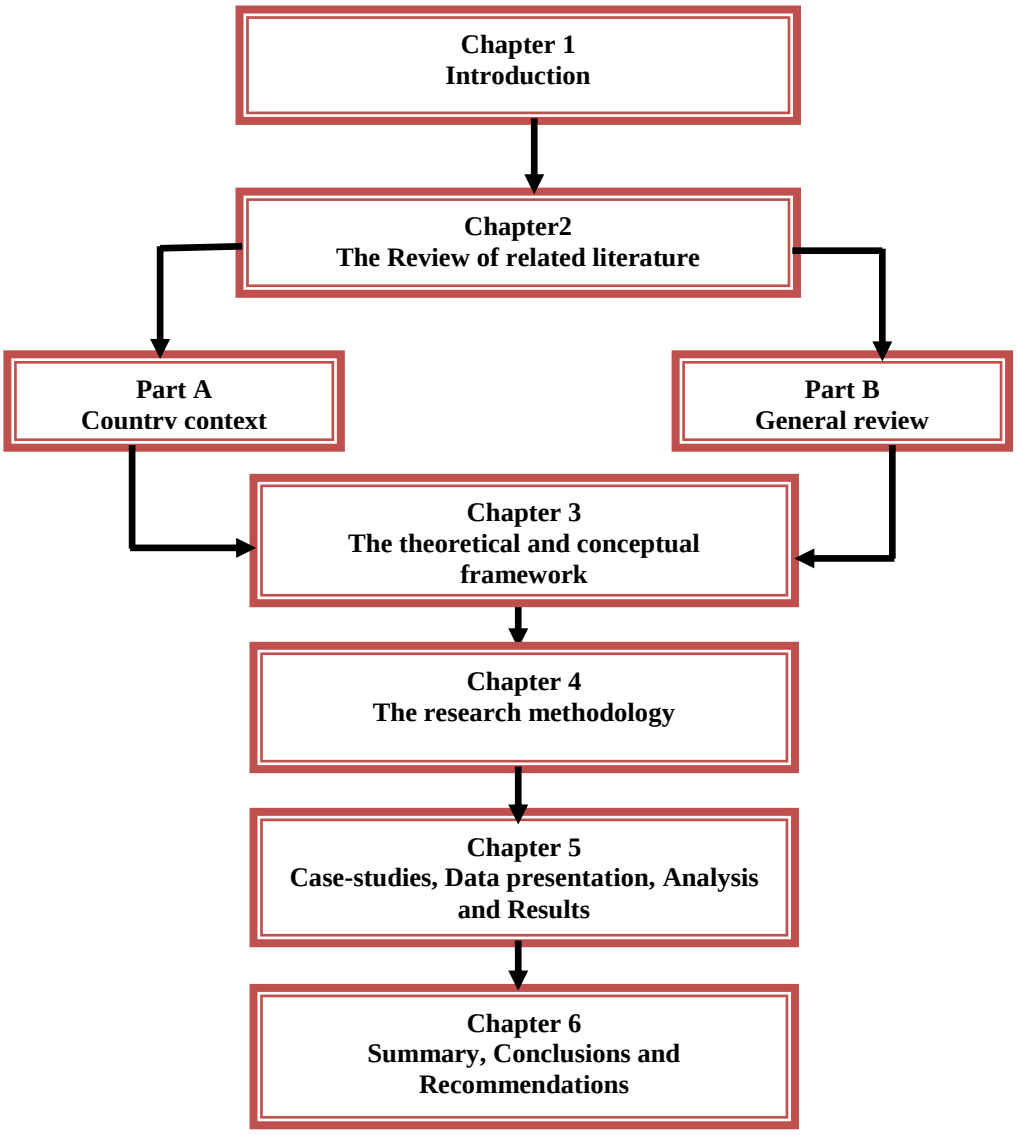

Figure 1.1 Graphical representation of the thesis structure

Chapter 2: The Review of Related Literature

To lay a foundation for the theoretical framework of this research, a review of related literature is necessary. The review consists of two parts. The first part discusses the country context of the study, the construction industry and the education sector in Nigeria while the second part presents a general review of the key issues and variables of the study.

Part A: Country Context

2.1 The Overview of Nigeria

Nigeria is located in the tropical zone of the West African sub-region and shares common borders with the republics of Niger, Chad, Cameroun and Benin. It covers a land area of about 924,000 square kilometres and is the most populous country in sub-Saharan Africa (World Bank, 2008). The location of Nigeria north of the equator causes it to enjoy a humid tropical climate. There are two marked seasons; the wet and the dry seasons. In the Southern part of the country, the long rainy season lasts from March to end of July and from early September to Mid-October while the dry season starts from late October to early March. In the northern part of the country, the short wet season runs from June to September while the long dry season extends from October to mid-May.

The population statistic of Nigeria is widely disputed by demographers but the World Bank report (2008) puts it at 151 million people with an annual growth rate of 2.8 percent. This is projected to decline to 2.5 percent by 2015. The population is predominantly rural. However, 48 percent of the population lives in urban areas. This is also projected to increase to 55.5 percent by 2015. Figure 2.1 shows the map of Nigeria.

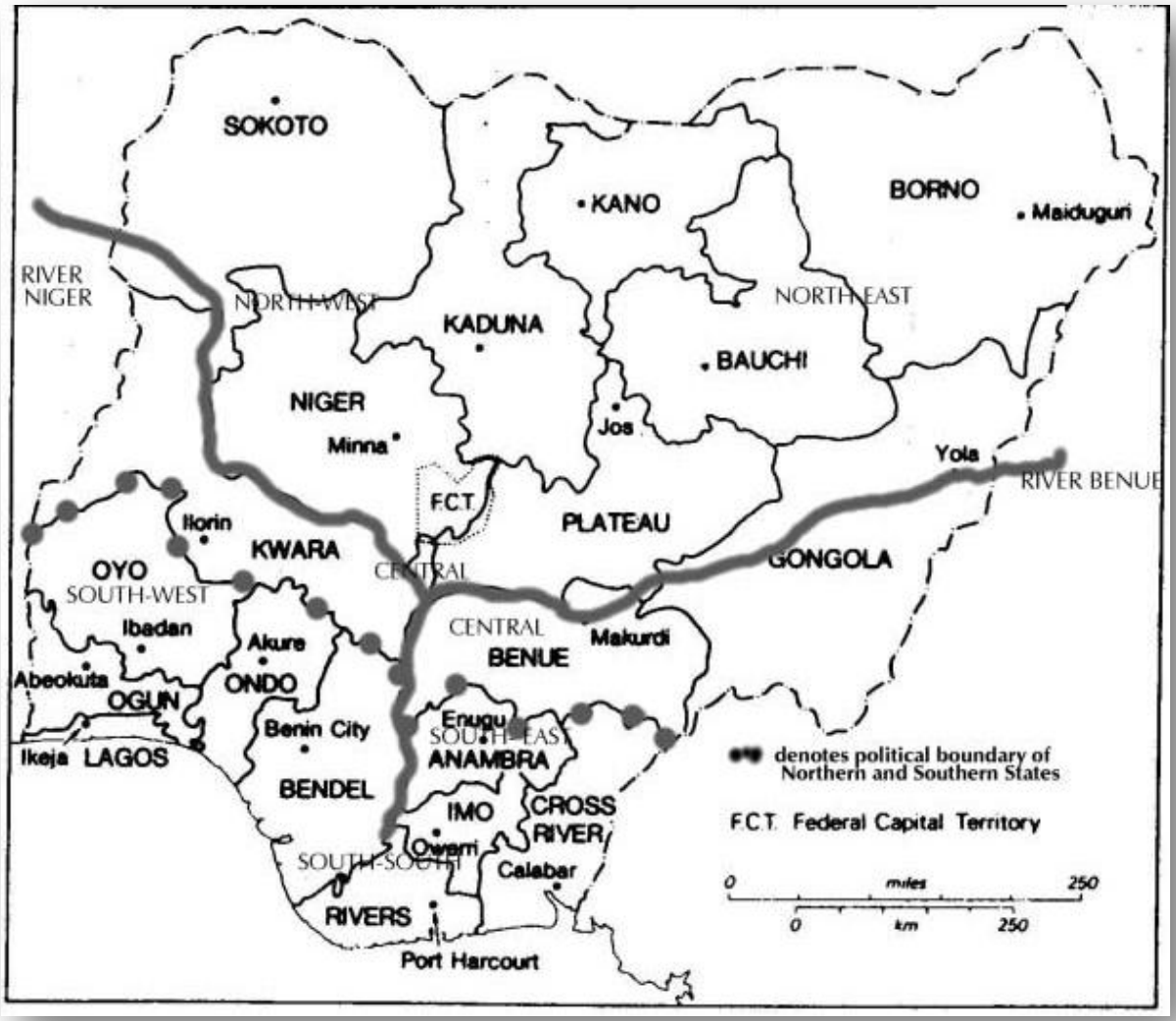

Figure 2.1: Administrative map of Nigeria
Source: Ayogu (2000)

Four ethnic groups make up about 65 percent of the population, namely;

- The Fulanis and the Hausas in the North;
- The Ibos in the South East; and
- The Yorubas in the South West.

The Edos, Ibibios, Kanuris, Nupes, Tivs, Chamba, Ekoi, and the Ijaws; though small ethnic groups are also important to the country. Islam is the dominant religion in the North, accounting for about 47 percent of the population while Christianity is dominant in the South; accounting for about 30 percent of the population. The rest of the population holds traditional beliefs (Ayogu, 2000:17).

Nigeria has immense physical and human diversity. The topography ranges from the mangrove swampland along the coast to the tropical rain forest and the savannah. The savannah vegetation consists of 3 types; Guinea Savannah, Sudan Savannah, and Sahel Savannah. Guinea savannah is the most extensive vegetation covering the middle part of the country. It extends from Ondo, Edo, Anambra and Enugu states in the south through Oyo to beyond Zaria in Kaduna state. The Sudan savannah stretches from the Sokoto plains to the entire north-eastern part. The Sahel savannah is found in the extreme North-East, close to the Lake Chad region (FME, 2003:4). The Sahara desert encroaches into the extreme or furthermost Northern part of the country. The Natural resources include mineral, forest and water resources (ADB, 2008). While the people of Nigeria are divided into about 250 different ethnic groups and languages, the official language is English.

Nigeria is a federation comprising of thirty six (36) states and a federal capital territory located in Abuja. It operates a federal constitution with a three-tier government structure made up of the Federal, State and Local Governments respectively. The country now has 774 local governments in the 36 states and the federal capital territory of Abuja. In 1999, Nigeria ushered in a new democratic administration after multiple decades of military rule and has now held two consecutive and successful free elections (2003 and 2007 respectively).
In terms of Nigeria's socio-political situation, civil unrest is frequent in some of the country's regions, particularly, in the oil rich Niger-Delta where increased participation and/or total control of oil revenue is disputed. Occasional ethnic and religious tensions are sources of socio-political conflicts notably in the Northern parts of the country with a predominantly Muslim population. The most recent of such conflicts is the Jos crisis which claimed over 400 lives (Chiedozie, 2010). Over the last two decades, Nigeria has been characterized by emigration and substantial internal migration. As any other country in the sub-region, it has resulted into a considerable amount of rural-urban migration.

This tendency has exacerbated the social situation in the cities and therefore put great pressure on the cities. A contrary situation exists in the rural areas with relatively little circular migration between them. Moreover, internal migration in recent years has also been characterized by forced displacements due to conflicts over crude oil mining and refining, religious and ethnic conflicts; and conflicts related to the democratization process. The United Nations currently estimates the number of internal migrants at well over two million (ADB, 2008).

2.1.1 Economy and business environment in Nigeria

The economy of Nigeria is the second largest in sub-Saharan Africa, ranking behind South Africa and possessing one percent of the world's proven petroleum reserves (Ayogu, 2000:6). Oil revenue accounts for about 90 percent of all foreign exchange earnings and agriculture; mostly at subsistence level, employs more than half of the population. However, though the sector employs more people in the population, it contributes only about 25 percent of national output (Ayogu, 2000). Perhaps, agricultural exports which were formerly Nigeria's main export commodities, but now less important are responsible for this low contribution. Agriculture is predominantly a private sector endeavour with small holders dominating production and growing food mainly for their own consumption. With an estimated Gross Domestic Product (GDP) growth rate of about 2.5 percent, per capita income growth was negative for the greater part of the 1990s. Nigeria's urbanization rate of 5.3 percent is one of the highest in the world leading to loss of strong labour force for agriculture. Moreover, the rate of job creation has been far less than the rate of growth of the urban labour force. This, combined with an education system that is not attuned to the production of appropriate manpower required to support robust growth has led to high levels of unemployment and underemployment (Akpobasah, 2004:20).

Income distribution is highly skewed in Nigeria, such that perhaps, less than 15 percent of the population actually benefits from the GDP growth. According to Akpobasah (2004), the weakness of the Nigerian economy in the past three decades is not unconnected to its dependence on oil. Indeed, the country is a textbook example of an economy under the influence of the Dutch disease with its deleterious impact on the development of other aspects of the real sector. Oil, which generates about 90 percent of foreign exchange earnings and 75 percent of government revenues contributes about 30 percent to the GDP and employs only about 3 percent of the labour force. Government is the dominant force in the economy; employing about one million people and due to the huge resources accruing to the government, it turned into a centre for corruption. However, Government has in recent years acknowledged that the situation is so bad that it warrants a frontal attack.

The business environment in Nigeria is diversified; particularly, the private sector consisting of enterprises of all sizes. These private enterprises are predominantly informal micro and small scale businesses. The medium and large scale private enterprises are mainly corporate in structure and urban based with many having joint ownership with foreign partners. The activities covered in this sector range from Agriculture, industry, financial services, physical

and social infrastructure, trade and commerce. The potential of the private sector and in fact the entire business environment in Nigeria has not yet fully developed due to the constraints of costs. Growth and Employment in States (GEMS) (2010) reports that the high cost of doing business in Nigeria arises from ill-defined property rights and insecurity in enforcement of contracts. GEMS (2010) identify such other constraints as administrative barriers and lengthy procedures of business registration, inadequate infrastructure and lack of skilled labour, weak marketing and security problems.

Given the above background, the diversification of the productive base of the economy away from oil has been a major development challenge for successive governments. In 2003, the Federal Government of Nigeria (FGN) conceptualized a reform based plan for economic recovery, growth and development. This plan called the National Economic Empowerment and Development Strategy (NEEDS) was eventually launched in 2004 as a response strategy to the numerous challenges facing the nation. The reform programme was designed to last from 2004-2007 for the first phase and 2008-2011 for the second phase. NEEDS hinges the growth of the economy on private investment. It therefore emphasizes the evolution of a private-led market economy with competition as a driving force. The plan spells out several policy measures aimed at improving the business climate and spur non-oil economic growth. The specific strategies under NEEDS (2004) include:

- Substantial increase in infrastructural investment (such as housing, water, electricity, and transport);
- Facilitating access to finance;
- Facilitating direct low-cost credit to the productive sector;
- Imposition of selective import restrictions; and
- Launching of a comprehensive privatization and liberalization programmes.

Supplementary strategies aim at removing administrative barriers to private sector activities. Recently, the Federal Government of Nigeria took several measures to create a more stable business environment including the establishment of several anti-corruption agencies. These agencies include the Economic and Financial Crimes Commission (EFCC) and the Independent Corrupt Practices Commission (ICPC). They have contributed immensely to the improvement of transparency and accountability in the system and are gradually reducing the

cost of doing business in Nigeria. The policy and strategies of this plan for the educational sector will be discussed in subsequent sections of this thesis.

2.2 Construction industry in Nigeria

The construction industry in Nigeria is relatively underdeveloped. It accounts for about 2 percent of the Gross Domestic Product (GDP). This compares poorly with South Africa with 5.1 percent contribution to her GDP (Statistics South Africa, 2002; CIDB, 2004; Shakantu, 2004:36). However, the industry has been growing rapidly at about 12 percent per annum; much faster than 2.5 percent growth rate for the GDP (GEMS, 2010). This was evident in the report of the performance of this sector where building and construction constitutes one of the key drivers of the economy. By the second quarter of 2009, the percentage growth rate for building and construction was 11.82. Figure 2.2 shows the sector statistics for the growth rate of the major economic drivers and their percentage growth rates.

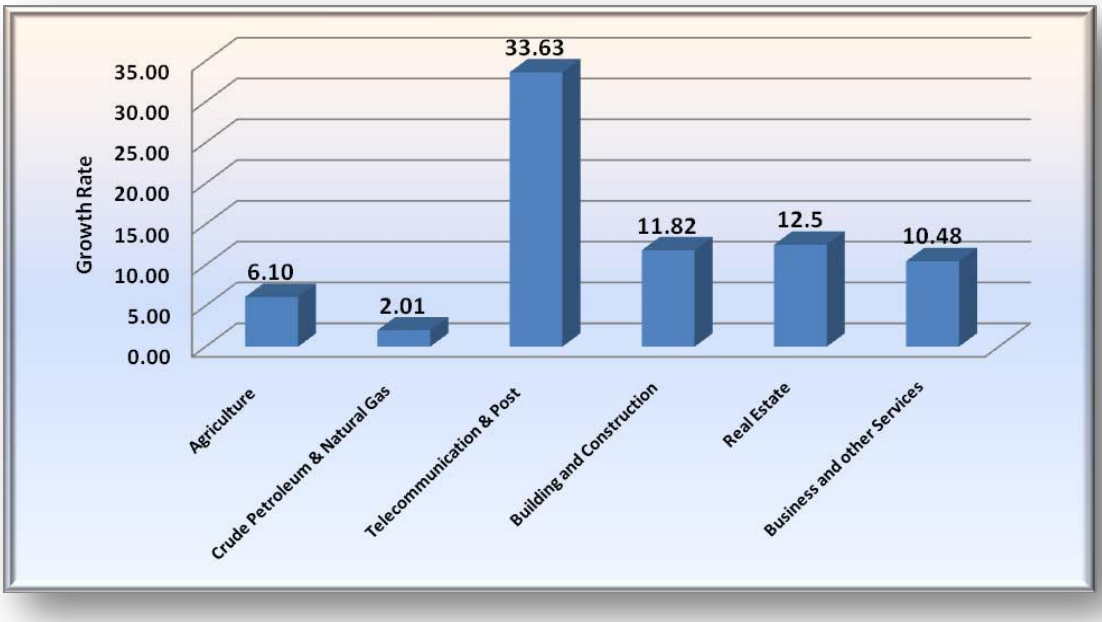

Figure 2.2: Drivers of the economy by the second quarter of 2009.
Source: NBS (2009).

The construction industry in Nigeria plays an important role in facilitating the provision of facilities such as transport, water, electricity, education, housing and health. It consists of two sectors; the formal sector and the informal sector. The formal sector is based on the institutional and regulatory framework designed by the colonial masters, long before

independence. The design was intended to facilitate the implementation of the various development plans of the administration at that time. The Public Works Department (PWD) which is now renamed the Federal Ministry of Works and Housing (FMW&H) undertakes most Federal government construction work. Although the traditional procurement system inherited from the British rule is still popular, other procurement routes/methods are increasingly being adopted for many projects in the country. For example, Build, Operate and Transfer (BOT), Construction Management (CM), and Design and Build or Construct (D&B).

The construction industry in Nigeria operates within the institutional structures of government and other organizations. Government ministries interact directly with the industry by regulating its activities or act on behalf of government as financiers, suppliers or clients. Non-Governmental Organisations (NGOs) also influence the activities of the industry in areas of unionism, employers' organizations, private clients, donor agencies, professional bodies, research institutes and private educational institutions. The agency responsible for overseeing the activities of the industry and implementation of state policies is Federal Ministry of Works and Housing (FMW&H) and the State Ministries of Works in the various States. Other regulators include the Ministry of Environment (MOE), Ministry of Water Resources (MOWR), Ministry of Lands, Survey and Urban Planning (MLSUP), Federal Environmental Protection Agency (FEPA), Education Trust Fund (ETF) and Ministry of Health (MOH).

The informal sector is polarized with few foreign construction companies undertaking large infrastructural projects, while the local or indigenous contractors constitute the remaining part of the sector. The local contractors consist of small builders and clients seeking to engage in the construction of single dwelling houses for families and so rely on labour intensive methods of construction. This is probably because labour is cheap and therefore makes economic sense than the capital intensive option of construction. Besides, this group of contractors who operate mainly as small scale enterprises in the industry finds it difficult to access credit facilities required to execute large infrastructural construction projects (ADB, 2008). Due to this constraint, the local contractors bid for small projects within the limits of their financial capacity and cannot therefore compete favourably with their foreign counterparts.

In his study of the performance of the construction industry in Nigeria, Dantata (2008:8) observes that the performance of the construction industry in Nigeria is constrained by a significant number of challenges including the lack of local skilled labour, power shortage, the unavailability of materials, and the unethical practices that are very common in the industry. GEMS (2010), agrees with this view by stating that the growth of construction industry in Nigeria is constrained by multiple failures in areas such as obtaining land for development, high risk cost and delays in obtaining planning permission, registration of title to land, obtaining construction permits, skill shortages resulting from poor system of technical and vocational education and training; and high cost of construction materials arising from tariff and non-tariff barriers on the import of building materials such as steel, timber and cement.

This situation is compounded by market failures which have disadvantaged the indigenous contractors and concentrated market powers in the hands of few large/mega developers (including multinational construction companies) and contractors who have the technical and financial muscle to execute large projects. Consequently, construction costs in Nigeria are said to be amongst the highest in the world. However, despite these shortcomings, several opportunities exist in the industry especially in education, and subcontracting sectors which makes it very attractive for investors (Dantata, 2008:10).

2.2.1 Demand for construction Products

There is a high level of demand for construction in Nigeria. This is due to the acute shortage of housing especially in cities with high population growth such as Lagos, Abuja, Kano, Onitsha and Port Harcourt. According to GEMS (2010), the institutional and property market is booming due to investment in hotels, shopping malls, students' hostels and office buildings. Higher government investment in infrastructure and public buildings has also contributed to the increasing demand for construction. According to Nongiba (2008), government plays a major role in the demand for construction products. It is estimated that central governments allocates 4.5 percent of the GDP to the provision of infrastructure while the private sector demand contributes about 3 percent. In the private sector, property and real estate developers also constitute a significant demand for construction products. In Nigeria, these groups carry out construction based on speculation of prices and in some cases meet specific demands by clients.

The huge housing deficit in Nigeria constitutes a serious challenge to the government. As more and more Nigerians make towns and cities their homes, the resulting social, economic, environmental and political challenges need to be urgently addressed (Raji, 2008). Studies of the housing situation in Nigeria put the existing housing stock at 23 per 1000 inhabitants. Housing deficit is put at 15 million houses while the cost of providing them is about four times the annual budget of Nigeria. Home prices and rents, on the other hand, have grown ahead of general inflation. To make matters worse, the composition of homes for sale and rent on the market has been inexorably shifting towards very expensive homes (Nubi, 2008; Kabir and Bustani, 2009).

2.2.2 Supply of construction products

The supply side of the construction market is organized along traditional relationships where the design of a project is separated from its construction both in time and space. Clients normally appoint a designer who is in independent practice for designing the project. After the design, the designer's assistance is sought in the appointment of a contractor to execute the project. Price and quality are the main criteria for selection. Some private clients may undertake the building project on a small scale without regard to the traditional procedures of appointing consultants, formalizing the contractors' appointments, and seeking the necessary approvals/permission. These clients operate in the informal sector; typifying the practice in most developing countries in Sub-Saharan Africa (Wells, 2001).

Private professional practices in the industry are small with rarely any single practice providing all the services of traditional practices in the construction industry. Such traditional practices include Architectural consultancy, Engineering and building services, and Quantity surveying. In the public sector, the Federal Ministry of Works and Housing and its parastatals, their state counterparts, Education Trust Fund and the various World Bank agencies act as consultants apart from their functions of implementing policies and regulating the activities of the industry. Few multinational construction companies such as Julius Berger, Costain, G. Cappa, Spibat, and Borini Prono operate in the industry. The local contractors belong to associations such as Building and Civil Engineering Contractors of Nigeria (FOBACEC) and Real Estate developers association of Nigeria (REDAN). Building and Civil engineering contractors in Nigeria are classified and registered according to classes based on qualifications, capability and financial strength. The classes range from A to D and registration is done by the Federal Ministry of Works and Housing (www.fmw.gov.ng/).

However, the supply side of construction in Nigeria according to GEMS (2010) is constrained by the same factors that constrain the industry as a whole. Such constraints include a poorly or inadequately developed market for professional services, poor access to and high cost of finance, undefined property rights and insecurity in enforcement of contracts, lack of skilled labour force, and administrative barriers and lengthy procedures of business registration.

2.2.3 The Construction Labour market in Nigeria

Available data on the labour force in Nigeria suggests that the figure is about 54.7 million (UN, 2004). According to the National Bureau of Statistics (2003), industrial and service sectors employ about 23 percent and 13 percent respectively. In another study on the construction labour statistics in Nigeria, Olaye (2005) reports that the number of persons engaged by the construction sector in the year 2000 was 338,140; years 2001 and 2002 recorded about 336,184 and 257,097 respectively while the year 2003 recorded a total of 331,705 persons. The first quarter of the year 2004 recorded 330,516 as the number of persons engaged. Despite the low contribution of construction to economic activities, there is no doubt that the industry employs a significant number of the labour force in the country. This is probably because of the labour intensive nature of the industry. While it employs labour directly on the demand side, it indirectly employs labour on the supplier side.

Much of the employment is provided on an informal basis which offers low security of employment and poor working conditions including unnecessary exposure to health and safety hazards. Due to the lack of skilled domestic labour force, about 30 percent of the skilled labour is imported from the neighbouring republics of Ghana and Benin (GEMS, 2010).

2.3 Educational system in Nigeria

Education is a fundamental tool for the construction of a knowledge economy and society in all nations (World Bank, 2001). Through its capacity to augment productivity, it increasingly constitutes the foundation of a country's competitive advantage. However, the challenges of finance, efficiency, equity, equality and governance have frequently slowed down the potential of education to fulfil this responsibility in developing countries. These challenges are compounded by rapid changes in technology, globalization of trade and labour markets (Salmi, 2001).

Nigeria's formal education system follows a 6-3-3-4 structure. This means that the duration of secondary education is six years made up of two three-year cycles and tertiary education for an average of four years. The basic policy with regard to structure, curriculum and school year is centrally determined. Other areas of educational delivery are modified to suit local requirements. A survey of the Nigerian educational system (UNESCO, 2007) reveals that primary education enrols about 81 percent of the relevant age group and graduates about 69 percent of these. This means that more than half of all the children complete primary school. Secondary school enrolment grows at an annual rate of over 10 percent but access remains constrained by poor infrastructure, policy changes and shrinking economy. Technical education is substantially neglected by policy makers and oriented towards the teaching of traditional hand skills. These skills are often divorced from labour market requirements. Tertiary education enrols about 11 percent of the students who complete secondary education. This compares poorly with economic competitors such as South Africa which enrols over 17 percent of students in similar age group (Task Force, 2000). Tertiary education in Nigeria is offered in universities, polytechnics and teacher training colleges.

The management of education is dictated by Nigeria's political structure based on federalism. Consequently, the administrative mechanism devolves some power to the state and local governments. The responsibility for the management of primary education is shared among the federal government, state governments, local governments, community committees and school committees. In the past few years, measures have been introduced to encourage active participation of local communities in the running of schools. The Federal Ministry of Education is responsible for the harmonization of educational policies and procedures of all states of the federation through the National council of education (NCE). The NCE is the highest policy making body in educational matters in the country and consists of the Federal minister of Education and all the state commissioners for education. It is assisted by the Joint Consultative Committee (JCC) on Education which is composed of all the federal and state directors of education, chief executives of education, parastatals and directors of university institutes of education. The committee is headed by a director of the Federal Ministry of Education and it advises the NCE on a wide variety of educational issues. The National Universities Commission (NUC) is a parastatal under the Federal Ministry of Education. It is responsible for the development of universities in the country.

The National Examinations Council conducts examinations for some junior secondary schools and for senior secondary schools jointly with the West African Examinations Council. The National Business and Technical Examinations Board administer technical and business examinations. The National Commission for Colleges of Education provides advice to the Federal Ministry and co-ordinates all aspects of non–degree teacher education in the country. Other relevant bodies include the National Commission for Polytechnics which overseas the polytechnic education in Nigeria, the National Board for Technical Education, the National Commission for Mass literacy, Adult Education and Non-formal Education , the National Commission for Nomadic Education, the Joint Admissions and Matriculation Board; and the Nigerian Educational Research and Development Council (FME, 2009).

2.3.1 The philosophy of education in Nigeria

The National Policy on Education (2004) highlights the overall philosophy of Nigerian education as follows:

- Education is an instrument for national development; to this end, the formulation of ideas, their integration for national development and the interaction of persons and ideas are all aspects of education;
- Education fosters the worth and development of the individual, for each individual's sake and for the general development of the society;
- Every Nigerian child shall have right to equal educational opportunities irrespective of any real or imagined disabilities, each according to his or her abilities; and
- There is need for functional education for the promotion of a progressive united Nigeria; to this end, school programmes need to be relevant, practical and comprehensive; while interest and ability should determine the individual's direction in education.

This philosophy is based on the development of the individual into a sound and effective citizen, the full integration of the individual into the community and the provision of equal access to educational opportunities for all citizens of the country at the primary, secondary and tertiary levels (both inside and outside the formal school system). The National Policy on Education (2004) specifically provides that the goals of university education shall be:

- To contribute to national development through high level relevant manpower training;
- To develop and inculcate proper values for the survival of the individual and society;
- To develop the intellectual capacity of individuals to understand and appreciate local and external environments;
- To acquire both physical and intellectual skills which will enable individuals to be self-reliant and useful members of the society;
- To promote and encourage scholarship and community service;
- To forge and cement national unity; and
- To promote national and international understanding and interaction.

These goals cannot be realized without adequate and functional infrastructure. The development of a sound educational system depends largely on the capability of the institutions to effectively perform their functions and offer the required services for the sustenance of the system. The university system in Nigeria is confronted with a lot of drawbacks including inadequate funding, lack of infrastructural facilities and leadership problems (Udida, 2008). The belief in the efficacy of education as a powerful instrument of development has led many nations to commit much of their resources to research and establishment of educational institutions at various levels (Ajayi and Ekundayo, 2008). Funds allocated to higher education should therefore not be considered a waste, but a long term investment which benefits the society as a whole.

2.3.2 The Nigerian University System

Currently, Nigeria has a total of 104 universities and perhaps, the largest university system in Sub-Saharan Africa. Although South Africa's tertiary enrolments are higher, Nigeria boasts more institutions (Saint, Hartnett and Strassner, 2003:266). These universities were founded and owned by the Federal Government, the various State Governments and private institutions between 1948 and 2009. The distribution of these Universities and the periods of their foundation are shown in Table 2.1

Table 2.1 Age distribution of Nigerian Universities

Year of Foundation	Federal	State	Private
1948-1975	13	0	0
1976-1998	12	11	0
1999-2009	2	25	41
Sub-Total	27	36	41
	Grand Total: 104		

Source: Adapted from NUC (2010).

Both the federal and state governments have almost reached their peaks in the establishment of new universities. However, the numerical strength of Nigerian Universities does not reflect the extent of student enrolments. According to the National Universities Commission (NUC) (2002b), the overall enrolment growth rates of federal universities far exceed the government policy guidelines. Yet, the number of candidates annually seeking enrolments into the universities far outnumbers the available spaces. The rising student numbers generate an enrolment rate of 340 per 100,000 persons and an average staff/student ratio of 1:24. With 63 federal and state universities (27 and 36 respectively) enrolling over one million students, Nigeria's university system supports numerous programmes and attracts many students from neighbouring countries.

The system also supports the country's research capacity and produces most of its skilled professionals. Much of this expansion centres in the South East region, where a combined annual growth rate of 26.4 percent leads the nation in the fields of science and engineering. In a study on the performance of universities in Nigeria, Okorie (2009) observes that the access to university education in Nigeria is a mere six (6) percent, far below the world average of 16 percent. This is a sad commentary because it does not encourage the development and effective utilization of the enormous human resources in the country.

Reporting on the university system and its institutional structures, Saint *et al*. (2003:265) note that more than any other country in Sub-Saharan Africa; the structures exist in Nigeria that could provide for a rational and effective development of the university system. Practically,

the university system in Nigeria has not developed rationally as expected. This situation generally presents enormous challenges to the government and the university system in particular

2.3.3 Challenges of the University system in Nigeria

The challenge of satisfying the yearnings for university education and the improvement of educational quality in Nigeria are severely constrained by dwindling resources/lack of funding, inadequate physical infrastructure, over population in the universities, poor work environment, poor leadership/management and increasing shortage of qualified academic staff. (Saint *et al*., 2003; Ajayi and Ekundayo, 2008; ADB, 2008; Udida, Bassey, Udofia and Egbona, 2009; Ojogwu and Alutu, 2009). For a better understanding, brief discussions of these challenges are provided as follows:

- *Lack of funding*: One of the major problems now confronting the educational system in Nigeria is under funding. This is not surprising because in recent times, government revenues have reduced considerably due to dwindling oil revenue and rising debt service obligations (Aina, 2007). The government which statutorily bears the cost of education in the country now gives low priority to the funding of education. Aina (2007:5) laments that the underfunding in Nigerian higher education system has reduced research activities and quality of teaching. Aina (2007) notes that allocations to the universities are grossly inadequate while students enrolment continues to rise.

  It is clear that the system has not had the financial resources necessary to maintain educational quality in the midst of significant enrolment expansion. For example, the total recurrent grants per student in 1999 were at only one third of their 1990 level (Saint *et al*., 2003). Funding shortfalls in the face of rising demands cannot promote educational development in Nigeria. The inability of the Nigerian government to objectively accept and implement the 26 percent funding formula for education recommended by UNESCO impact negatively on the performance and sustainability of the university system (Udida *et al.*, 2009). Corroborating the above observation, Odia and Omofonmwan (2007) report that UNESCO recommends 26 percent of the total budget of a nation to be allocated to education, but Nigeria has not exceeded 10 percent budgetary allocation to education. Government funding has neither been guided by criteria linked to strategic national priorities, nor by a concern to attract

talent (lecturers and students) into careers linked to the public good. Internally generated revenue has contributed a relatively constant share of about 15 percent of universities' recurrent budget in recent years; varying among institutions from a low of 4 percent to a high of 37 percent (Hartnett, 2000). A cursory look at the national budgetary allocation to education in Nigeria shows a nominal annual increment of funds as shown in Table 2.2.

Table 2.2 Total Federal Government Annual Budget for Education for the Period 1995-2004

	Federal Government Annual Budget Total (N)		
Year	**Capital**	**Recurrent**	**Total Allocation**
1995	44,500.0	66,744.5	111,457.5
1996	44,477.0	76,744.9	121,221.9
1997	88,693.0	99,396.2	188.089.3
1998	129,700.0	116,607.4	246,342.4
1999	88,000.0	161,000.0	249,000.0
2000	119,300.0	239,300.0	358,860.4
2001	70,000.0	139,600.0	209,951.3
2002	375,000.0	321,378.0	696,000.0
2003	88 billion	677 billion	765 billion
2004	439 billion	459 billion	898.0 billion

Source: FME (2004)

This does not keep pace with the increasing demand of education on public finance. At this point, it appears clearly that more creative and adaptable financing strategies are needed in Nigerian universities to avoid the risks of declining educational quality, resource use and learning effectiveness which confronts it at the moment. When funding becomes inadequate to maintain institutional performance in teaching and research, universities elsewhere in the world respond by supplementing their public funding with locally generated revenue. In this regard institutional response to resource constraints can range from income diversification to creative entrepreneurship.

It appears the Nigerian government encourages this approach because in the year 2000, it granted administrative and financial autonomy to the universities. This means that universities are expected to specialize in areas of comparative advantage identified through a participatory strategic planning process. Many universities have not taken full advantage of this policy. A more progressive commercial approach to funding and resource allocation than before has to be considered. Nevertheless, the benefits of the autonomy can only be captured through active strategic planning by the universities.

- *Inadequate physical infrastructure*: The state of physical infrastructure in Nigerian Universities is not encouraging. This poses serious setback to the attainment of university goals and objectives. Capital projects to meet the expanding programmes cannot take off due to lack of funds. The effects of dwindling resources in the Nigerian university system can be explained, according to Aina (2007) in such adaptive mechanisms as: curtailment of laboratory/practical classes, limited number of field trips, reduction in the attendance of academic conferences, curtailment of the purchase of library books, chemicals and basic laboratory equipment and reduction in research grants and maintenance budgets.

  These steps have not brought about any significant improvements, hence the detrimental effect on teaching and research. For universities to effectively perform their roles there must be adequate funding to maintain the existing buildings, research and construction of new facilities.

- *Over population in the universities*: In retrospect, the Nigerian university system had a good beginning in the early colonial era as an instrument for national reconstruction and development. However, recent expansion in students' intake and overpopulation has put immense pressure on the available facilities in the system. As stated earlier, the overall growth rates have far exceeded government policy guidelines. In recent years, enrolments have increased more quickly than the universities can accommodate or support. According to Momoh (2006), the total enrolment in universities was 72,425 in 1980. In 1990, the total enrolment rose to 180,871 with an increase of 246 percent. By 2007, the total enrolment figure had risen to well over 1.4 million (NUC, 2007b).

- *Poor work environment*: For a better performance on the job, the best environment should be provided in the university system. Analyzing the learning environment of the university system in Nigeria, Ojogwu and Alutu (2009) describe the environment as unconducive, unproductive, unattractive and unhealthy with decayed and dilapidated infrastructural facilities. Commenting earlier on this state of affairs on staff productivity, Akuezuilo (2007:32) states that many academic staff are employed without the required designed facilities to cope and perform their jobs. Consequently, students' selection processes are often associated with abuses and marginalization, standard of academic programmes politicized and in some cases not relevant to the cultural values and needs of the society. These inadequacies can neither promote, nor sustain the high quality standards needed in the university system.

- *Poor leadership/management*: In Nigeria, the capacity to run the university system and individual institutions has battled to contend with the increasingly large and complex university system. However, it seems professional management techniques and training has generally not been applied. Large and complex university systems demand the application of proactive management styles that address problems through innovations. It requires administrative structures that facilitate institutional responsiveness to the wide range of university stakeholders (Saint *et al.,* 2003:268). According to Ekaette (2001), a lot of managers in Nigerian university system do not possess the requisite skills (in human relations) needed for effective and efficient leadership. This has led to poor leadership and ineffective style of administration. Udida *et al.* (2009:8) observe that some leaders in Nigerian universities do not have the zeal to supervise and monitor institutional activities and staff exhibit non-chalant attitude towards work. Academic and research output have been very low due to lack of grants for research and publications, staff welfare is neglected and communication with internal and external audiences are weakly developed (*Saint et al.,* 2003). This lack of professional institutional management and strategic planning has constrained the development of the university system in Nigeria. This is further compounded by a pervasive culture of corruption within the wider society.

- *Increasing shortage of qualified academic staff*: Shortage of qualified academic staff within the university system is seriously hampering all efforts to enhance educational quality in Nigeria. During the past decade salary erosion and fragile democratic environment have prompted a substantial emigration of academic staff. According to NUC (2002b), between 1998 and 1990, over 1000 lecturers left the federal university system. This trend has continued to date. The NUC (2002b) further states that an estimated 30 percent of approved academic positions are presently vacant and gave a staffing shortfall of about 51 percent within the system. This situation is further compounded by insufficient output from national postgraduate programmes especially at doctoral level in the face of rising enrolments. Staffing shortage is most acute in the engineering, science and business disciplines. In contrast, no shortages exist in the arts and education fields (NUC, 2002b).

2.3.4 Government's effort

In an effort to find a solution to these challenges, the Federal government of Nigeria's reform based plan for economic recovery, growth and development (NEEDS) recognizes that the Nigerian education system is dysfunctional. NEEDS (2004) describes the system as characterized by low standards, institutional decay and youth militancy. The Federal Government's educational sector policy thrusts under NEEDS include to:

- Empowering Nigerians to acquire right attitudes, skills and knowledge for the labour market;
- Provision of unhindered access to basic education;
- Improvement in the quality and delivery of education; and
- Improvement in literacy rate.

The specific targets of NEEDS include to:

- Increase adult literacy rate from 57 percent to 65 percent;
- Expand total school enrolment;
- Expand institutional capacity to produce quality manpower;
- Increase the transition rate from junior to senior secondary education;
- Ensure that 60 percent of schools have conducive teaching and learning environments;

- Ensure that 80 percent of all teachers are professionals;
- Review school curricular to incorporate technical, vocational and entrepreneurial skills.

These targets have obvious implications for the University system, particularly, physical infrastructure. Presently, progress is very low and therefore remains a major challenge for the government. The challenge of improving quality and educational effectiveness in Nigerian university system does not only demand proactive and strategic institutional planning but also a responsive and reflective approach to system management. El-Khawas (2001) appears to offer a framework for this approach by stating that a responsive institution must be adaptive in its orientation. It must intentionally consider changing circumstances by identifying appropriate ways to adapt and take responsive actions. Teaching and learning require constant adaptation to the rapid change in the global competitive knowledge economy. The university system in Nigeria needs a radical transformation at all fronts. The application of a building facilities management model to support the transformation process must be given priority for an effective education system.

Part B: General Review

2.4 The background of building performance evaluation

Until recently, building performance was evaluated in an informal manner and lessons learned were applied in the next building cycle of a similar type. Knowledge of building performance was passed from one generation to another generation of building specialists who were often craftsmen with multiple skills (Preiser, 1995:19). These multiple skilled craftsmen (artists/designers, draftsmen/builders) had not only a complete control over the building delivery process but also a thorough knowledge of the cultural, social and economic context in which the clients operated. Today, the situation has completely changed. Due to the proliferation of construction specializations, advancement in technology and the rising demand for higher quality in service delivery by customers and stakeholders, building performance has become more documented and formal (Douglas, 1996:10). An increasing number of technical codes and regulatory requirements such as accessibility for the

handicapped, energy conservation, hazardous waste disposal, fire safety, health and safety are now placed on building facilities.

To balance and comply with these requirements, Palm (2007:35) states that building performance must be properly articulated and documented. However, in the last two decades, thousands of new buildings and renovations have been planned, designed and constructed but only a small proportion will ever be evaluated against user-needs and service delivery objectives (Lackney, 2001:2). This, according to Zimring and Rashidi (2008) can be attributed to the following:

- Lack of funds set aside by organizations for performance evaluations;
- Lack of the necessary skill to conduct performance evaluations;
- Professionals often do not like to have their work judged by their peers;
- Difficulties in establishing a clear link among user assessments, positive outcomes and the physical environment; and
- The complex and fuzzy nature of the relationship between facility design and facility performance evaluations.

Organizations have successfully acquired buildings that do not perform due to poor operations. Perhaps, this can be attributed to the fact that quite a number of buildings are procured with none of the key players showing significant interest in their performance. Once the building has been completed and delivered to the client, the project team disbands and quickly moves on to the next project without learning from the one they have just done (Leaman, 2004; Mayaki, 2005). Leaman (2004) reports that a survey of buildings in the United Kingdom shows an average of two percent loss in productivity due to building-related problems. Leaman (2004) concludes that buildings do not work as well as they should for their users and so demand more than their management is prepared to give especially in the public sector.

A well designed building should be suited to context and purpose with sufficient space and access. Knirk (1993) affirms that usable buildings should address a broad spectrum of occupant-related issues such as creating a physically comfortable environment with adequate lighting, temperature, noise control, technology and equipment, and user-access needs. To ascertain how well the building is serving the needs of the occupier or to identify any major

deficiencies in its overall performance, building performance evaluation is very crucial. Generally, the traditional functions of the major professionals in the built environment (Architects, Builders, Engineers, Quantity Surveyors and Estate Surveyors/Managers) have remained virtually the same (Mbamali, 2005:2). However, in the built asset sub-sector, the trend has been a departure from the traditional estate manager/surveyor towards the creation of an all-embracing professional (the facilities manager) who harnesses the disparate and complementary functions of these major professionals into a cohesive approach to workplace management (Park, 1998:103). The primary objective of this profession (facilities management) is to relieve the organization of the burden of ensuring that support structures and services run efficiently so that it can concentrate on its core activity and thereby boost profit earning and productivity.

Spedding and Homes (1998) define facilities management as an umbrella term under which a wide range of property and user-related functions may be brought together for the benefit of the organization and its employees as a whole. The scope of facilities management encompasses the workplace, facility support services, property, corporate real estate and infrastructure (Chitipanick, 2004:364-365). Its function is performed at three levels, namely; the tactical, operational and strategic levels (Omirin 2005:8). Building performance evaluation finds expression at the level of strategic building design, construction and management (Omirin, 2005:10-20).

Building performance evaluation is therefore a diagnostic tool which allows facilities managers to identify and evaluate critical aspects of a facility in order to develop design guidance and criteria for future facilities (Preiser, 1995:1; Obiegbu, 2005:10). It is part of a wider field of knowledge referred to as facilities management. Building performance evaluation also refers to an extension of what was formerly called post occupancy evaluation (POE). The concept deals with the continuous process of systematically evaluating the performance and effectiveness of one or more aspects of buildings in terms of accessibility, aesthetics, cost effectiveness, productivity, functionality, safety, security and sustainability (Zimring, 2001:42). In an analysis of the relevance of building performance to facilities management, Douglas (1996:10) asserts that building facilities are key functional as well as economic resources and should therefore be regarded as assets rather than liabilities. Douglas (1996) opines that a basic tool for the realization of this objective is building performance evaluation.

In recent times, there is a growing concern for organizations to structure their built assets to enhance the performance of their primary processes or core businesses. Building performance evaluation provides this platform as it is now assuming a prominent place in the strategic plans of most business concerns (Then, 2003: 69-80). Generally, there are two broad divisions of building evaluations; user-based systems and expert-based systems (Barrett and Baldry, 2003:119-128). The user-based system uses a building's occupants to evaluate the suitability of a building for their particular needs and hence is also known as post-occupancy evaluation (POE). The expert-based evaluation relies on experts' assessments and typically covers far more areas, such as provision for information technology, organizational growth, energy efficiency and changes in work style.

This study is directed towards good practice in facilities management with emphasis on design and user-needs; it therefore uses only the post-occupancy evaluation (POE) approach. Accordingly, the performance evaluation seeks to assess the extent to which a building after construction, occupation and use meets its conception and design purpose (Ornstein and Ono, 2009:152; Obiegbu, 2004:8). Mayaki (2005:3) states that the objective of performance evaluation is to improve design practice and create a more functional facility that better supports service delivery.

As a facilities management function, the role of building performance evaluation in facilitating organizational performance is widely acknowledged. Amaratunga and Baldry (2000:294.) state that performance evaluation is a key factor in ensuring the successful implementation of organizational strategy in facilities management. Amaratunga and Baldry (2000) maintain that it does not only play a vital role but also provides standards for establishing comparisons. Omirin (2005: 8) states that facilities management is a very important tool for strategic studies, budget preparation, and organizational change. Facility performance evaluation allows an organization to establish its position through the careful and consistent evaluation of facility performance; it stimulates action through identifying what is to be done, who is required to act and in what manner (Amaratunga, Baldry and Sarchar, 2001:179-189). This suggests that the objective of performance evaluation is not limited to optimizing the running costs of buildings; though that is important, but encompasses other strategic management issues in an organization.

For construction organizations, it encompasses the design and management of space and related assets for people and processes in such a way as to support the achievement of organizational mission and goals (Amaratunga and Baldry, 2002:178). As external and internal factors place more demands upon facilities in an organization, resources must be suitably combined for efficiency and cost. Performance evaluation explicitly focuses attention on feedback loops and this influences behaviour. For educational institutions, this feedback loop influences the overall project design for improved performance and flexibility. Facility performance provides a mechanism to learn from the past and evaluate contemporary future trends in the use of facilities (Cots, 1990:40; Lackney, 2001:17). It is therefore believed that the collection, interpretation and analysis of information about performance of buildings provide the key to better planning and design for the future.

2.5 General building design principles/Performance evaluation aspects

Performance evaluation provides organizations with an effective and holistic tool for proactive building facilities management and improvement. It therefore evaluates the physical aspects of buildings with respect to design and user objectives. Preiser (2003) notes that building performance evaluation focuses on observing and measuring certain aspects of the building or facility and evaluating them in relation to the intended or actual use. Accordingly, performance evaluation focuses on such performance aspects/mandates as functionality, accessibility, productivity, aesthetics, cost effectiveness, flexibility and adaptability, health safety and security and environmental sustainability (Zimring, 2001). Each of these aspects consists of a series of indicators which are significant and relevant to successful building performance. They further provide a framework which can track design decisions from the outset through to completion and occupation.

2.5.1 Functionality: Functionality is a property given to an artefact in order to create a practical effect (Warell, 2001). An important effect can be described as space use. It therefore reflects the user's demands and needs in order to gain good productivity. For existing buildings, there is the need to answer the question "How well is the building suited for the activities of the user?" This can be described as fit for purpose relating to the building's operational layout or functional elements. The functional elements according to OECD (2006) deal with the fit between the building and its activities. This relates to how well the building directly supports activities within it while being responsive to the specific needs of the organization and its occupants both qualitatively and quantitatively. Functionality of

educational buildings pertains to space needs and requirements, system performance as well as durability and efficient maintenance of building elements. The key issues in the evaluation are space design and internal logistics. Effective and holistic space management and operations, initial investments in capital, maintenance and repairs, provision of feedback loops between the building brief and completed building, learning spaces and support facilities to accommodate at least 95% of the student enrolment, workspace for staff and school administration must be considered as critical indicators in the evaluation process (OECD, 2006).

In a study of the development of a methodology for the evaluation of existing buildings in Norway, Kathrine and Svein (2004) report that building functionality is mainly related to the following:

- How the building meets core business demands regarding space functions;
- How the spaces are suited to the various functions (size, shape, effectiveness);
- The internal and external logistics; internal logistics refers to nearness to closely related functions within a building while external or global logistics refers to nearness to closely related functions within a group of buildings; and
- How the building is suited for co-use.

Kathrine and Svein (2004) argue that a building's functionality is a measure of the extent to which the space supports core business. In this regard, ineffective or unsuitable buildings cause reduced core business productivity and to avoid this, the building's functionality must be improved by carrying out building changes. If the adaptability of the building is poor, the building will probably stay inefficient and non-functional throughout its life span. This means that the core business organization should consider finding other facilities and abandon the existing ones. For educational buildings, Kathrine and Svein (2004) posit that substantial changes occur with new teaching methods and technology; hence the old fashioned corridor-and-classroom schools are no longer suited for modern education. Design of building facilities that meet or exceed the functional expectations of owners and facilities managers must consider the above issues as well as thorough understanding of the historical precedent and knowledge of current design practices for the building type.

2.5.2 Accessibility: It has been accepted that accessibility of the built environment is critical to the creation of a socially inclusive society (Ormerod and Newton, 2005). Buildings and the environment facilitate social inclusion for everyone including disabled and older people. If some people are excluded from facilities that provide education, employment, entertainment and other services, then, discrimination will not only occur but also opportunities for integration will completely be eroded. Simply put, if disabled become unnecessarily dependent on others for support in using the built environment, integration will be lost. An inclusive building design considers people's diversity and removes unnecessary barriers and exclusions in a way that benefits all. According to Prideaux and Roulstone (2009), while removing architectural barriers may allow people with disabilities to circulate within and around a facility, other factors such as transportation affect their ability to fully participate in activities. Accordingly, designers and other suppliers of services and goods need to provide equal access for all without undermining the needs of people with disabilities.

The National Institute of Building Science (NIBS) (2009) defines accessibility as ensuring that all individuals make use of transportation, buildings and facilities, programmes and services, employment opportunities and technology without unnecessary barriers. Providing equal access means offering all users the same provisions for privacy, security and safety. Providing equal access removes discrimination and protects human rights. An accessible building provides opportunity for all people to fully participate and contribute to their families, communities, and society. Accessibility features should blend well with the design. The principles and processes that support accessible design, according to NIBS (2009) include knowing what standards and laws to apply and when to apply them based on such items as project developer, project use, funding sources, building type, housing type and ownership. In planning for access, consideration should be given to access early in the process and throughout all phases of the project. The goal of accessible design is to provide equal use of the built environment for all people (Prideaux and Roulstone, 2009). This implies being proactive and planning for flexible design features and products that will increase the likelihood of providing equal use of the built environment for all people.

In a study on the involvement of end users in the briefing process, Lawson (2004) reports that designers do not consult with disabled people as building users. The study shows that accessibility is not achieved in finished buildings due to:

- Ignorance of access issues by clients;

- The brief being usually too vague and insufficient information being supplied;
- Existence of conflicts that lead to compromise; and
- Lack of compulsion/guidance.

The extent of consideration of access issues in building is minimal. Ormerod and Newton (2005) argue that design features tend to benefit people with mobility impairments the most when given high priority by designers. For example, sanitary features, level approach, suitable parking, horizontal and vertical circulation. However, Ormerod and Newton (2004) maintain that less priority is given by designers to features that would benefit people with sensory impairment and learning disabilities such as pictorial, tactile and Braille information. Ancillary devices to assist learning, way finding devices (maps, graphics and land marks) and acoustics are least likely to be considered by designers in terms of accessibility. This confirms the view of Lawson (2004) that designers put more priority on design features that will benefit accessibility for those with mobility impairments such as wheel chair users. Clearly, buildings and their environment facilitate or hinder social inclusion. Inaccessible buildings automatically exclude some people from using them. For example, a building with steps hinders people with mobility impairment and parents with push chairs. Similarly, buildings with poor lighting and inappropriate colour/tonal contrast exclude people with sensory impairments (Lawson, 2001).

From the perspective of briefing for accessibility, the role of the designer is very critical. While designers ensure that buildings and their environments facilitate social inclusion, there are significant barriers to achieving this due to lack of understanding of disability and how people with disability interact with buildings, the regulations and legislation that support this interaction. This is the problem in Nigeria where legislation and its associated regulations on design for accessibility is rarely observed or enforced.

2.5.3 Productivity: Productivity relates to the occupants well-being (physical and psychological comfort) including building elements such as air distribution /ventilation, lighting, workspaces, systems and technology (NIBS, 2009). The effective management of these elements reduce the incidence of sick building syndrome (SBS) which impacts negatively on productivity. Sick building syndrome refers to acute health and comfort problems (such as irritation of the eyes, nose, and throat, lethargy and dizziness) which

appear to be experienced by the sufferers during the time they occupy or spend in a building and disappear soon after they leave the building (Okolie *et al*., 2009). Atkin and Brooks (2005:122) state that reported effects of sick building syndrome may combine with other job-related factors to produce an overall sense of dissatisfaction among workers in a workplace and this leads to under-performance. Minimizing the constraints placed on employees at their workplaces therefore increases social and economic productivity. Design strategies that increase user satisfaction and improve individual group work effectiveness should be considered not as costs extra but as productive investment that enhances an organization's overall success. NIBS (2009) reports that productive building designs are based on five fundamental principles, namely:

- The promotion of health and well-being which shows that indoor environments strongly affect human health. An effective workplace should be designed to support and enhance the health and well-being of its occupants;
- The provision of comfortable environment which ensures that a workplace is designed and operated to provide the highest achievable levels of visual, acoustic and thermal comforts for its occupants. It also encourages work effectiveness;
- Design for the changing workplace which is the cornerstone of change and innovation. This ensures that spaces with flexibility, social support and technology are provided to promote new ways of working in organizations;
- Integration of technological tools which ensures that designed pathways and spaces for technological tools and distribution networks are properly and effectively integrated. This is required in modern office environments to enable workers perform their duties well; and
- Assurance of reliable systems and spaces (reliability) which is one of the greatest concerns for a building occupant. It directly affects the safety, health and comfort of the occupant. This principle ensures that workers rely on building systems, equipment and tools that function consistently and properly maintained.

Buildings can be effective and exciting places to work and live in. This is possible when they encourage adaptability, improve comfort, support a sense of community and provide connections to the natural environment, natural light and view. Mayaki (2005) posits that the most compelling argument for improving building efficiency and performance may be found in the relationship between occupant comfort and worker productivity. The strength of this

argument lies in the fact that organizational effectiveness today means using building spaces wisely. This does not just mean cutting costs but designing buildings for flexibility to enable space to change as work groups or projects evolve. Wise use of space also means creating the right context for concentration, learning, communication and collaboration, particularly for educational institutions.

2.5.4 Aesthetics: This refers to the physical appearance and image of the building elements and spaces as well as the integrated design process (Lawson, 2001). It simply conveys an idea of what is beautiful or artistic. One of the 10 criteria for the evaluation of educational buildings in the United Kingdom is aesthetics (CABE, 2009). Issues in this aspect relate to how the elevation reflects the design concept to create an inspiring building. This implies that the building must be good architecture in its own right and that occupants can derive pleasure in working, eating, learning, teaching, playing and socializing in the building. The aesthetics sub-committee of the whole building design group (WBDG) (2009) describes aesthetics as a branch of philosophy dealing with the nature of the beautiful and with judgments concerning beauty. Put differently, it is the branch of philosophy which studies concepts of beauty. Aesthetic theories in architecture are related to the clients' or designers' preferences. These preferences change and are usually discussed as history after those preferences have been realized as buildings.

From the perspective of a design objective, the building appearance is inherently a choice made by the architect in full collaboration with the client, building users, other consultants and the public in the achievement of good building performance (Okolie and Shakantu, 2009a). The concept of aesthetics is best understood from the overall scope of architecture which was first formulated in the first century BC by Vitruvius, a Roman architect. In his book titled "The Ten Books of Architecture", Vitruvius describes the obligations of architecture as commodity, firmness and delight. Commodity addresses how the building serves its functions and can be made more useful to the occupants; firmness refers to a building's ability to stand up over time to natural forces and delight refers to the aesthetics. Delight can also refer to how a building makes you feel; ranging from awe to joy to fear to love to peace. Delight in the built environment, whether positive or negative can also be auditory, tactile, olfactory, thermal, visual and even kinaesthetic (NIBS, 2009).

Although these three aspects of architecture or building have been re-interpreted over the centuries, they still serve to describe the importance of accommodating a building's requirements; remaining standing and offering the observer and user, a form of image, a sense of place and an interpretation of the technology of the time. In evaluating the user/occupier needs in educational building facilities, Okolie and Shakantu (2009a) posit, it is important for clients and building users or occupants to be well informed or knowledgeable about the possibilities and performance aspects of buildings. This, Okolie and Shakantu (2009a) argue will enable users/occupiers to assist the architect and design team in providing building designs that meet the client's and user's needs. Most designers agree that aesthetically, successful architecture comes from an integrated approach (Heitor, 2005; CABE, 2009; Robinson and Robinson, 2009). This can be achieved through a well formulated brief and evaluation involving the client, building occupants and building delivery team. This process leads most effectively to the best aesthetics solution. To understand the basic process, techniques and language by which architectural decisions are made, NIBS (2009) recommends:

- Appropriate application and thoughtful integration of the visual elements of architectural design; and
- Full and constructive participation of all members of the design and delivery team.

This involves steps that foster successful integration of many factors and design disciplines that influence good building design. The design disciplines and associations that impact aesthetic decisions include architecture, landscape and interior design, lighting design, professional engineers, facilities management, planning and construction specification.

2.5.5 Cost effectiveness: This refers to the selection of building elements on the basis of life-cycle costs. It means weighing options during concept design development and value engineering, basic cost estimating and budget control.

The economics of building has become as complex as its design. Clients today require cost-effective buildings but this can be interpreted differently depending on interests and objectives. The clients' interests according to Federal Facilities Council (FFC) (2001) may be influenced by the following;

- The lowest first cost structure that meets the brief;

- The building with the longest life span;
- The facility in which users are most productive; and
- The building that offers the greatest return on investment.

It is difficult to summarize cost-effectiveness by a single parameter, particularly when an economically efficient building is likely to have one or more of these attributes. True cost-effectiveness is better determined by the life-cycle approach where all costs and benefits of a given building are evaluated and compared over its economic life.

The design of a building is cost-effective if it results into benefits equal to those of alternative designs and has lower life costs (NIBS, 2009). The basic economic assumptions, costs and benefits which according to Lackney (2003) reflect needs for cost-effective constructions are based on the following principles:

- The use of cost management and value engineering throughout the planning, design and development process;
- The use of economic analysis to evaluate design alternatives; this includes projected cost impacts of energy/utility use, operation and maintenance and future system replacements; and
- Consideration of non-monetary benefits such as aesthetics, historic preservation, security and safety.

Cost is one of the most significant factors in the successful delivery of any building project. It must therefore be kept under review to ensure that the brief and the design match budget and that the overall life-cycle cost is kept appropriately low (Robinson and Robinson, 2009).

2.5.6 Health, Safety and security: The design and construction of safe and secure buildings continue to be the primary goal of clients, designers and facilities managers. Health and safety in building performance refers to the physical protection of occupants and assets from man-made and natural disasters (NIBS, 2009). According to OECD (2006), issues in this performance mandate include portable water, sanitary spaces, fire safety, emergency lighting, secure design, building system, material and condition, vehicular and pedestrian traffic. For educational buildings, OECD (2006) explains that provision of portable water ensures that drinkable water is available to staff and students in an adequate number of locations; sanitary

spaces means clean and separate spaces for men and women, functioning toilets which are available in sufficient numbers and locations; fire safety which means space for a functioning fire alarm system and egress for building occupants; emergency lighting refers to adequate space for a functioning emergency lighting system; secure design means space that protects the physical security of the building occupants and their belongings. Building system, material and condition ensures that no building system presents a health or safety hazard to its occupants while vehicular and pedestrian traffic provides safe traffic patterns. Designing buildings for safety requires a proactive approach that anticipates and then protects the building occupants, resources, structure and continuity of operations from multiple hazards. Some injuries and illnesses are related to unsafe or unhealthy building design and operation. These, according to NIBS (2009) can be prevented by measures that take into account issues such as indoor air quality, electrical safety, fall protection, ergonomics and accident prevention.

Most security and safety measures involve a balance of operational, technical and physical safety methods (Kroll, 2009). For example, to ensure a given facility is protected from unwanted intruders, a primary operational approach might stress the deployment of guards around the clock; a primarily physical approach might stress locked doorways and gateways while a technical approach might stress camera surveillance and warning sirens. In practice, however, all approaches are usually employed to some degree and a deficiency in one area may be compensated by a greater emphasis in the other. When these are addressed at the beginning of a project, safety measures can effectively be integrated into a total design.

Although security within a building is very important, it sometimes slows down communication (Kroll, 2009). For example, if swipe cards are needed to move between floors in a building, it can work against communication during emergencies. However, effective secure building design involves implementing counter measures to deter, detect, delay and respond to attacks from human aggressors. Security can also be enhanced by the design of front desk and reception area so that everyone who enters the building can be easily seen. Secure building design provides for mitigating measures to limit hazards and prevent catastrophic damage if an attack occurs (Lackney, 2003).

2.5.7 Flexibility and adaptability: The early design and development of a building project involves many goals. The client may talk about the final design providing a user-friendly

work environment and future flexibility. This means a design concept that can easily be modified or serve a variety of purposes for a diverse group of people in terms of physical spaces. Robinson and Robinson (2009:2) argue that the design of educational buildings must demonstrate adaptability and flexibility. This means spaces that are easy to modify, serve multiple uses and/or users, accommodate future technologies and are life cycle cost-effective. Robinson and Robinson (2009:3) maintain that building requirements are constantly evolving and if a building is to meet the aspirations set down, it must be adaptable and flexible; this is to allow for changes both to technology and to the requirements of its user groups (staff and students) and the community in general.

Flexibility manifests in addressing human needs within the mainstream of building design. It simplifies life for everyone by making products, communications and the built environment more usable by as many people as possible at little or no extra cost. (Heitor, 2005:46). The design of educational buildings should consider a mix of spaces with different spatial conditions. Heitor (2005:50) posits 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. For example, instead of bearing walls that impede flexibility, the structural solutions should favour columns, light partition walls and wide spans. It must be possible to allow spaces to flow into each other by movable wall and door elements that can be moved throughout the day to accommodate a variety of projects and student groups.

In a study of the user needs/demand and adaptability of buildings in Norway, Kathrine and Svein (2004) state that the evaluation of flexibility and adaptability requires an answer to the question, "How easy or difficult is it to change a building to meet different demands from the user?" Flexibility in this context therefore means freedom of changes within the same space function.

2.5.8 Environmental Sustainability: This refers to the environmental performance of building elements and strategies. A major consideration in today's energy conscious world is the design of buildings that are environmentally responsible. Robinson and Robinson (2009) state that sustainable building designs should demonstrate a commitment to innovation, use of passive design elements and active systems, materials, finishes and selections with the ultimate goal of eliminating any foot print on the environment.

Design decisions on educational buildings should consider issues relating to optimization of energy use, site potential, protection and conservation of water, enhancement of indoor environmental quality and optimal maintenance practices. This agrees with OECD (2006) which outlines sustainable building design factors as site planning, sustainable systems and sustainable methods and materials. OECD (2006) explains that in site planning, the building must demonstrate an environmentally responsible site planning by maximizing the site potential. In the area of sustainable systems, the building must demonstrate effective and efficient use of water, energy, recycling, waste management and day lighting. Sustainable methods and materials entail an effective demonstration of the use of sustainable construction methods and building materials.

Evaluation of the above aspects is critical to this study. The results must feed back into the building cycle in order to raise awareness among those who can influence funding and design improvement.

2.6 Design principles for educational buildings

Until the middle of the twentieth century, building design concepts for educational institutions did not evolve. Prior to this time, those who designed educational buildings had assumed that as long as certain minimum standards for size, acoustics, lighting and heating were met, a productive environment existed; the 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). 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 cannot 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 (Mutlaq, 2002; OECD, 2003; Sanoff, 2003; Robinson and Robinson, 2009).

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 (2005:15) 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. According to Heitor (2005) 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 will 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. Educational buildings strongly emphasize stimulating and adaptable learning environments with spaces that support various styles of teaching and learning. 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. Special attention should be given to the building programme and budget. Robinson and Robinson (2009) further state that exploring and developing a comprehensive brief includes both functional requirements and aspirational goals. The functional and technical aspects can be clearly briefed but the aspirational and inspirational aspects of the brief require a commitment from all stakeholders (stakeholders include the consulting team, users, the institution and the parent body/community). Every aspect of the project (planning, the building form and structure, finishes, embedded technology,

adaptability and flexibility, sitting and sustainability) must contribute to the effectiveness of the building in supporting and enhancing the whole academic environment.

Clearly, it is not feasible for a single person to address all aspects of the design and development process. An integrated team approach to solving the complexities of design can produce superior buildings. This approach produces buildings that represent better value for the owner, more efficient operation, more economical to run and better occupants comfort (Obiegbu, 2005:12).

It is axiomatic that better designs lead to better buildings, but the question is, what exactly constitutes better designs and how will such designs be realized? Ultimately, the answer to this question will be provided by a complex mix of judgments offered by a range of interested parties. However, for buildings in educational institutions, minimum design standards must be met. The Commission for Architecture and the Built Environment (CABE) (2009) provides ten assessment criteria which must be met by any school design in Britain to be accepted. These include;

- Identity and context (students should be proud to identify with the school);
- Site plan (making best use of site);
- School grounds (making assets of outdoor spaces);
- Organization (clear drawing of buildings);
- Buildings (form, massing and appearance working together)
- Interiors (excellent spaces for learning and teaching);
- Resources (deploying convincing environmental strategies);
- Safety (creating a secure and welcoming place);
- Long life, loose fit (adapt and evolve in the future); and
- Successful whole (design that works all rounds).

Each scheme is given an overall rating of ‘excellent’, ‘good’, ‘not yet good enough’, ‘mediocre’ or ‘poor’. Only schemes with overall design quality rating of ‘excellent’ or ‘good’ are regarded as acceptable. This minimum design standard for Building Schools for the Future (BSF) is an independent assessment based on clear objective and robust design standards laid down for a public sector building construction programme in Britain. Commenting on the above minimum design standards, Knight (2009) reports that the

standards add real teeth to the design process by making it faster, more efficient, best practice and thinking in school design. Although CABE'S assessment criteria capture most of the basic concepts and requirements of a building design, the context is peculiar to the British environment and therefore narrows the scope.

In a research on challenges of defining international design principles for educational buildings, Heitor (2005) identifies key factors that must be considered when addressing design quality in educational buildings. These factors are grouped into pragmatic concepts and design principles. The pragmatic concepts range from the functional ideas to the design solutions which address issues such as planning/schematic design and development. Heitor (2005) states that the success of this complex process implies a careful preparation phase involving those concerned with the project so that educational strategies, curriculum, targets and priorities of users will be reflected.

Heitor (2005) further states that the initial phase (the schematic design) anticipates a definition of the design brief based on functional ideas. The functional ideas address how a variety of activities should be executed differently by everyday users (students, lecturers, teaching assistants, visitors and guests) in the institution as a whole. Heitor (2005) therefore refers to the functional ideas as pragmatic concepts defined according to educational goals. These ideas are then translated into guiding design principles intended mainly as practical solutions to the school problems (functional, organizational and operational).

The design principles are basically reference terms which describe what a design "must be" or "should do" rather than what it "should look" or "be made of". They are concerned with building performance in functional, formal and economic terms. Simply put, how the school's physical space (design product) should work to support educational goals (task) and at the same time ensuring long term optimal use of the facility. Issues addressed in this stage include academic activities, schedule of spaces and fittings, required relationships of spaces and people within the physical and psychological environment, quality of space and construction as well as operating and life cycle cost considerations. Heitor's (2005) study adequately addresses the issue of functionality and design flexibility based on the reflective practice of educators and design professionals. These issues are critical to building performance evaluation and therefore relevant to this study.

In the United States of America, design principles have been developed for educational buildings. These principles, according to Lackney (2000) are predicated upon three conditions namely;

- Learning is a lifelong process;
- Design is always evolving; and
- Resources are limited.

Lackney (2000) further states that educational buildings and learning environments must satisfy the following;

- Enhance teaching, learning as well as accommodate the needs of all learners;
- Serve as community centres;
- Result from a planning process involving all stakeholders;
- Provide for health, safety and security;
- Make effective use of all available resources; and
- Allow for flexibility and adaptability of changing needs.

Based on these criteria, the success of a building in educational institutions is determined by evaluating how the building facility is functioning, how the learners/teachers are utilizing the space and how the educational process has changed as a result of the design in reality.

2.7 Evaluation of Design and user-needs in buildings.

There is a consensus of opinion among authors that building performance evaluation (or post-occupancy evaluation) should be an integral component of the building procurement process (RIBA, 1991; Duffy, 2001; MARU, 2001; Zimmerman and Martin, 2001; Alexander, 2002; Preiser, 2005). There is logic in the argument that one purpose for the evaluation of buildings in-use must be the provision of essential feedback to inform future actions (Carthey, 2006:57). Nevertheless, despite the support for building performance evaluation, many commentators agree that it has been neglected by the industry, particularly the design profession. Cooper (2001) states that building performance evaluation has been in almost 40 years of continuous neglect in the United Kingdom.

In particular, the use of building performance evaluation as a feedback loop to the design process has proved to be intractable. Viscer (2001) affirms that despite the logical imperative

to link building performance evaluation results to the front end of the design process, efforts to do so have had to struggle to survive. In the last few decades, there has been a renewed interest in building performance/post occupancy evaluation for the procurement and management of buildings (Cooper, 2001; Stanley, 2001). The research described in this thesis is indicative of this resurgence of interest. The concept of building performance evaluation has been described as an integral stage in the design and construction process (Lackney, 2001). As a mechanism for linking feedback on newly built buildings with pre-design decision making, its goal is to make improvements in public design, construction and delivery. Elsevier (2008:248) states that one important driving force for building performance evaluation is the opportunity for end–users to develop and articulate real needs concerning different functionalities of a building and its parts.

Elsevier (2008) submits that actual user-needs require support in formulation and capturing of the requirements in the building design. User need or requirement is a qualitative statement giving the expectation for the item being addressed. It is a subjective statement of what the product or assembly is intended to do. Designers have always argued that there is no such thing as one user or one best way to involve or evaluate the needs of the user in the design process (Cotts and Lee, 1992). In reality, the user or occupier is not necessarily a person; it may be an individual or an organization comprising different factions of people with different interests and needs (Dewulf and Van Meel, 2003). In the office design, for example, the term 'user' refers to a diversity of people, ranging from the rank-and-file employees to top management staff of the organization. All these people have different ideas, opinions, needs and interests, and in such situations as this, it may be difficult to arrive at common needs that will be incorporated into a single design.

Logical, as this argument might sound, the fact still remains that there is no single best method; user needs and the extent to which they are incorporated in design depends on the specific context. As Dewulf and Van Meel (2003) put it, the consultant designer, facility or real estate manager must be aware that the interests and needs of the user or stakeholder in the design depends on the political, legal, cultural, economic and social context in which they operate. The key issue in building performance evaluation is to determine whose judgments should be sought. The temptation and tendency is to regard expert opinion as always more correct and reliable. But the fact is that, for many aspects of a building and its environment, the experts are the people who know most about using it and these are the end-users (Sanoff,

2003; Okolie and Shakantu, 2009a). As stated earlier, when a decision to procure a building is being considered, there are three factions of people involved; the designers, the clients and the end-users. Traditionally, there has been very little communication between the end-user and the other two groups. The designers and clients have made decisions without consulting the end-users who there-after found that the new buildings do not meet their needs and this leads to costly alterations of such buildings (Atkin and Brooks, 2005:123).

Evaluation of user-needs provides both objective and subjective means of gaining insight into end-user needs or requirements in a building. However, the evaluation of user needs in a building is usually seen as a complex and difficult issue to reconcile. This is because buildings are designed, built and operated for various uses and purposes. Dewulf and Van Meel (2003:281-291) state that the purpose and use to which a building will be put is determined by the need of the user/occupier; if the building is for residential, manufacturing, agricultural, health or educational purposes, it will invariably be expected to satisfy the needs of their various end-users/occupiers. It follows therefore that the performance and success of a building is determined by the extent to which it meets the functional requirements of the end-user/occupier.

Commenting on this, Lomash (1997:167-171) outlines five fundamental questions that must be answered when designing and specifying the performance of a building, namely;

- Who is the user?
- What is the need of the user?
- Where does the need exist?
- When is the need to be fulfilled? ; and
- How long will the need exist?

Lomash (1997) adds that answers to the above questions are quantified, based on which the performance, as expected is also quantified through the development of performance objectives. Lomash (1997) maintains that the attributes of designs, materials, components, systems procedures and assemblies must be executed to meet the requirements of the end-user. In another view, Elsevier (2008:248) states that an important driving force for building performance evaluation is the opportunity for end–users to develop and articulate real needs concerning different functionalities of a building and its parts. Elsevier (2008) submits that

actual user-needs require support in formulation and capturing of the requirements in the building design. Whatever the case, in organizations that have a large tradition of employee participation and decentralized responsibilities, many users/stakeholders need to be involved and their needs accommodated in the design. In any case, many authors argue that meeting user-needs determines the degree to which the building facility contributes to the success of an organization (Barrett and Baldry, 2003:95; NAO, 2003; Kathrine and Svein, 2004; Zimring, 2008; Joe, 2009). This is where the facilities manager can play an important role.

2.8 Role of the facilities manager in design and evaluation of user needs.

Facilities managers are relatively new in the design process. Given this fact and their current number in practice, designers are usually uncomfortable and reluctant to take advice or directions from them. Perhaps, the architect may ask; how many facilities managers understand how an architectural/engineering firm designs a major project? Or from a builder's perspective, how many facilities managers understand how a manufacturing/industrial facility is constructed? It should be realized that facilities management is multidisciplinary and most practitioners come from a design/engineering background. Nevertheless, unless facilities managers are involved in the dynamics of the design process, clients will continue to get designs whose completed buildings perform sub-optimally even from the most reputable firms (Barrett and Baldry, 2003).

As the construction industry becomes increasingly specialized, facilities managers must take a more proactive part in the design process than any other facilities management function (Cotts and Lee, 1992:143). The reason for this is not far-fetched; certain business restrictions and contracts define the envelope within which the facilities manager and the architect operate in the user-designer equation; while the design project manager manages all design elements, the facilities manager manages all user requirements and owner inputs in the design, especially where the facilities manager acts as the surrogate client (Okolie and Shakantu, 2009a).

Issues covered by the facilities management function have been a subject of discussion by many authors. In the 1990s, there was an explosive growth of the functions to cover the total integration of people, processes and places in the service of a core business. Thompson (1990:12) argues that facility management is a profession devoted to facility planning and where building design meets business objectives. Thompson (1990) sees strategic facilities

management as a foundation around which to build daily traditions. An absence of this strategic foundation could result in a break of operational interface between the facility provider and the facility user. Thompson (1990) referred to what is called 'the facilities management spectrum' which follows the development of the facility function within the organization. This begins with the planning phase, followed by tactical planning and results in a reactive facilities management zone such as operations and emergency repairs. Thompson (1990) suggests that the development of a facilities management function within an organization has to start from the proactive strategic planning stage. The range of tasks, according to Thompson (1990) covers construction management and real estate activities. Nevertheless, Thompson's submission did not include how facility management can add value to the business as the focus was on buildings and processes.

The facilities managers' function at the proactive strategic planning stage would include inputs at the early design stage of the building. Similarly, Swensson (1998) identifies the responsibilities of a facilities manager to include the control of operating budgets and occupancy costs. Swensson (1998) seeks to get effective use of accommodation and tries to understand not only how an individual building performs but also builds an understanding of 'user demand'.

More proactive facilities organizations demonstrate the capability to go beyond the traditional means of identifying user needs and seek to achieve a clearer understanding of the expectations held by the users. To achieve this, Atkin and Brooks (2005:125) recommend that facilities managers should have a proper understanding of user satisfaction and building performance. This requires the examination of the complex set of interacting subsystems including physical environmental factors, job characteristics, organizational factors, socio-cultural characteristics and past experience of users; more detailed operational definitions of the variables being investigated (such as noise, space, health, privacy, satisfaction and productivity) should be developed. Generally, an improved fit between the physical setting and user functions; both at the individual and organizational level should improve performance.

Cotts and Lee (1992) in their contribution affirm that it is essential that a facilities manager understands the rules of design; those rules include identification of systems and subsystems, development of standards, regulations and constraints; they state that every building project

that is interior related must address one or more systems such as walls, floors, ceiling, fenestration and furniture. These systems dictate to the designer in varying degrees what should be designed in a particular space. Contributing to the above argument, Barrett and Baldry (2003:96) opine that facilities managers should understand how building evaluations can contribute to organizational effectiveness and communicate this to the design team and other people within the organization.

Facilities managers represent a new and untapped frontier for improving organizational goals and performance. But how do organizations know if their facilities are supporting organizational goals and user requirements? The answer to this question is by the introduction of building performance evaluation. Unfortunately, this is not well developed in most organizations and the construction industry as a whole. Organizations seem to have more information on items such as computers, photocopiers and refrigerators than their buildings and those that have a relatively good management of their assets, have little information concerning their building performance (Cotts and Lee, 1992). The fact that building facilities may affect an organizations' effectiveness and employee performance makes it imperative to evaluate them on a regular basis. When the design and use of a facility serves the people who use them and the program it houses, the project is functionally successful; when designs fall short of this goal, the failures are significantly more glaring.

In the early part of the last decade, three concomitant but independent moves were made in the construction industry of United Kingdom. These moves were made to re-energize the building delivery system and this culminated in the publication of three best practice standards, namely; Better public buildings report (2000), Charter hand-book (2000) and modernizing construction report (2001). The primary thrusts of these reports emphasize the need to ensure the functional performance of the constructed building facility; such that the morale and efficiency of those working in and using the facility is enhanced.

The better public buildings report (2000) particularly targets the functional performance of the completed building and stipulates firmly that well designed buildings must enhance the quality of life for the end-users. This demands a radical structural and cultural change in the procurement process, with the most fundamental being an arrangement that must ensure that other specialists contribute to design development right from the on-set (Cain, 2003:16). The Egan's 'Rethinking Construction' report of 1998; sees the total integration of design and

construction and the use of supply chain management as key to better value for the end-user client. It is important that professionals understand that end-user needs are central to any design decision.

One of the seven United States of America national construction goals demands that the design of buildings be improved sufficiently to deliver a 50 percent enhancement to the performance of building occupants. It is obvious that the functional performance and morale of the occupant/end-user can only be enhanced if the design is a collaborative and integrated effort. Put differently, an integrated design or team approach based on a thorough and detailed understanding of the precise functional requirements and interrelated values of the end-user, should be adopted (Cain, 2003:113-118).

The whole thrust of the team approach or integrated design is targeted at embracing everyone on both the supply and demand sides whose expertise and experience could be beneficial to the development of the design; this must obviously include the facilities manager. It is no longer sufficient for this understanding of the end-users' functional requirements to be constrained to the architects and engineers. These experts have traditionally, designed and constructed buildings with insufficient knowledge of the detailed needs of the end-user whom the completed building must satisfy (Barrett and Baldry, 2003).

Hakkinen and Nuutinen (2007:437) in their contribution, observe that if a building is designed without the basic end-users' requirements, it is unlikely to provide a suitable working environment. The authors agree that the process of understanding the precise functional requirements of the end-user must begin by embracing every member of the design and construction supply chain including the facilities manager. They maintain that the bricklayer, the carpenter and the electrician must have a clear and detailed understanding of the end-users' functional requirement which must be satisfied if the completed building is to be deemed a success.

The satisfaction of the end-users/occupiers comes from the ability of the building to enhance job/performance and environmental comfort and ultimately boost staff morale. Although a successful building design may be decided by a complex mix of judgments by different interested parties (ranging from functionality, visual consideration, occupants/user comfort, and return on investment), an integrated team approach to the design process will resolve

these complexities and produce superior buildings that represent better value for the owners, operate more efficiently, offer a better indoor environment for the occupier and are more economical to run (Obiegbu, 2005:15).

2.9 Benefits of building performance evaluation in facilities management.

Building performance has been described as the physical performance characteristics of a building as a whole and of its parts (Cliff and Buttler, 1995:3). It therefore relates to a building's ability to contribute to fulfilling the functions of its intended use. Building performance evaluation generally involves the inspection of a building between one and five years after its completion, and assessing whether and to what extent it has met its design goals for resource consumption and occupant satisfaction. The primary purpose of Building Performance Evaluation is to improve design practice. The methodology includes reviews of design documentation, interviews with operators and occupants, site inspection, analysis of utility data and occupant satisfaction surveys. Finally feedback is provided to the design team. Generally, Barrett and Baldry (2003:97-99) report, building performance evaluation can serve two broad purposes, namely;

- Improves current situations; and
- Aids in the design of future buildings (briefing).

Douglas (1996:23-32) outlines specific areas where evaluation of buildings can be useful. These include:

- Property portfolio review, acquisition and disposal;
- Highlighting of areas a building is lacking in performance;
- Helping in prioritizing maintenance or remodelling works;
- Providing identification of performance or early warning signs of obsolescence in buildings; and
- Assisting in achieving value for money from building assets through achievements as well as failures.

Baird (1996) maintains that the benefits of evaluation include:

- Better matching of demand and supply;
- Improved productivity within the workplace;
- Minimization of occupancy costs;

- Increased user satisfaction;
- Certainty of management and design decision making; and
- Higher returns on investment in buildings and people.

It is obvious from the above, that building performance evaluation should be considered a potential success factor by the facilities manager. Building performance is important in both inter and intra building sense. Douglas (1996:24) distinguishes between inter and intra building evaluation by stating that inter building evaluation takes place when one building is compared against another building. Douglas (1996) further states that this is important where clients or occupiers are undertaking a comparative analysis of various properties for acquisition or portfolio assessment purposes. On the other hand, intra building evaluation takes place when the building is assessed on its own without direct reference to other properties.

The goal here, according to Douglas (1996) is to ascertain how well the building is serving the needs of the occupier or identify any major deficiencies in its overall performance. It is in the later sense that this research is anchored which is in tandem with the definition of building performance evaluation earlier adopted for this study. Actual building performance inevitably declines over time. Douglas (1996:26), in a study of the relationship between actual building performance and performance of facilities in general states that actual building performance declines over time due to such influences as wear and tear, user abuse or misuse, climatic conditions and inadequate maintenance.

When this decline sets in, the building performance begins to fall below that of the facilities it is supposed to be supporting and this will in turn adversely affect the efficiency of an organization's facilities. Although Douglas' (1996) views are appropriate, the approach to the study was narrow, theoretical and technically driven. This study does not only consider the technical requirements in the evaluation but also dwells extensively on the user/occupier requirements, perceptions, and empirical assessment of design and use specifications. The evaluation of building performance in terms of user-needs provides a platform for facility managers to make their contributions to the achievement of organizational goals. Clearly, the efficiency and effectiveness of an organization is influenced by the physical environment in which it operates and since buildings constitute the main physical assets of an organization, a

thorough understanding of the physical workplace and its impact upon the user behaviour is vital (Barrett and Baldry, 2003:93).

From the standpoint of commercial property, facilities management functions concentrate on the interface between the physical work-place and people. But from the non-commercial property standpoint, the functions concentrate on the interface between the physical use-place and people (Hakkinen and Nuutinen, 2007:438). The premise of this view, according to Hakkinen and Nuutinen (2007) is that facilities management has a role to play in supporting organizational effectiveness in a non-commercial context and buildings in educational institutions are no exceptions. Therefore, the consensus among authors is that facility management is not only about buildings, but also about the people that occupy the spaces within the buildings, the processes they are supporting within known constraints of available resources and the prevailing corporate culture (Then, 2004:297-311).

Given the significance of buildings, it is difficult to argue that they do not have a role to play in sustaining the core business of an organization. If this role is to be fully explored, Lavy and Bilbo (2009:5-20) add that facilities and maintenance managers must have some way of determining the extent to which buildings under their control affect the performance of business in an organization. This further suggests that a facilities manager needs adequate knowledge of building performance evaluation or building diagnostics. Building diagnostics is the systematic study and evaluation of building performance. It is sometimes used to describe facility performance evaluation activities (Preiser, 2005:2). Douglas (1996) shows that building diagnostics is very relevant to facility management and as part of facility performance evaluation; it should be considered as a potential success factor to the organization. Douglas (1996) concludes that whether or not it is a critical success factor depends on the circumstances and needs of the organization.

In a study titled “post occupancy evaluation; how to make our buildings work better” Preiser (1995:4-5) opines that performance evaluation of buildings is a toolkit for facility managers. Preiser (1995) submits that the technique can be used for trouble shooting at the early planning and pre-design phases of a project. Thus, it can supply valuable advice on building performance aspects of specialized systems and materials as well as shed light on maintenance and operating costs. The other areas in which facilities managers can use the tool include problem identification of performance issues in occupied facilities, intra-agency

feed forward of design and guidance criteria to improve future facility performance and documentation of data for litigation purposes. This is because when facilities malfunction, the facilities manager is the first person to know. Preiser (1995) concludes that performance evaluation can be used for fine-tuning, after a building has been occupied. The fine-tuning process takes place when the occupants begin to adapt to the facility to suit their needs. In large facilities housing hundreds or thousands of occupants such as hostels and lecture theatres, this is necessary to get feedback from the occupants efficiently and rapidly in order to carry out the fine-tuning process. This study captures the numerous benefits of facility performance evaluation but provides no details on the social and psychological factors that affect the occupier of a building facility.

A survey carried out by the International Facilities Management Association (IFMA, 1994) to ascertain which aspects of performance are of concern to the facility manager before and after the occupancy of academic facilities found that prior to building occupancy, major performance problems include building code issues and changes as well as scheduling. One year after occupancy, the major concerns include operational problems with HVAC, building controls as well as peeling paints. Other problems in this area include breakages, health, safety and security as well as functionality/efficiency issues. The survey bears out the fact that facility managers do experience significant facility performance issues on a recurring basis. Their expertise in building performance can therefore be valuable input in the planning, programming and design process of new or remodelled facilities. The methodology for the IFMA (1994) study was the case study approach and therefore relevant and appropriate for this research.

2.10 Models for the performance evaluation of educational buildings

Various studies and models/methodologies exist on building performance evaluation. These studies include Preiser (1988); Kaplan and Norton (1992, 1996a, 1996b); Cash (1993); Ornstein (1997); Lackney (2001); Sanoff (2001); Kathrine and Svein (2004); Zimring, Rashidi and Kampshroer (2005); OECD (2006); Alexander (2008). These studies seek to systematically evaluate the performance and /or effectiveness of one or more aspects of an educational space or facility in relation to a broad range of space related issues. Research tools such as questionnaires, walkthroughs, focus group discussions and observations are traditionally used for such studies. However, several variables affect the performance of

buildings in educational institutions and based on previous studies, various models have been developed.

Models of building performance evaluation developed sensitively are useful not only for resource allocation in universities but also the development of new resource-based approaches for commercial competitive advantage (Amaratunga, 2000). In this study, some of these models are discussed as follows:

- The balanced scorecard (BSC);
- The process model;
- The building condition and students' achievement model;
- The school building assessment model; and
- The Programme on Educational Buildings (PEB) organizing framework for evaluating quality in educational spaces/facilities.

2.10.1The Balanced Scorecard (BSC).

The BSC was designed by Kaplan and Norton in 1996 in reaction to the increasing focus on purely financial measures for planning and management of business. The model integrates measures of customer satisfaction, process performance, product or service innovation and finance in linking short term operational control to the long term vision and strategy of business. Kaplan and Norton (1996; 2000) claim that the balanced scorecard provides managers with the instrument they need to navigate to future competitive success and that it addresses deficiencies in the traditional management systems. The model is built around the following four perspectives:

- Customer - which seeks to know what the existing and new customers value from the organization;
- Internal process - which seeks to know what processes must be excelled to achieve the financial and customer perspective;
- Learning and growth - which seeks to establish whether the organization can continue to improve and create future value; and
- Financial, which seeks to establish how value can be created for shareholders.

The four perspectives as expanded by Kaplan and Norton (1996) are shown in Figure 2.3

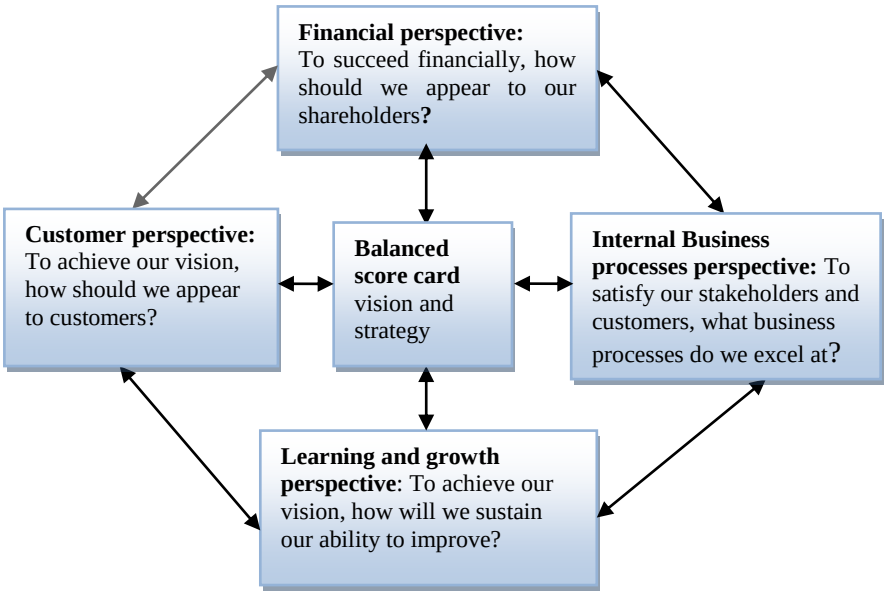

Figure 2.3 Perspectives of the Balanced Scorecard model.

Source: Kaplan and Norton **(1996).**

As shown in Figure 2.3, Kaplan and Norton (1996) state that the financial perspective shows the results of strategic choices made in the other perspectives, while at the same time establishing other long-term goals as well as a large part of the general ground rules and premises for other perspectives. The chosen measures will therefore represent the relevant stage in the life cycle of the product or service. The customer perspective describes ways in which customer value can be created, how it can be satisfied and why the customer will be willing to pay for it. The internal processes and development of efforts in the company should be guided by this perspective.

The internal business processes perspective involves describing all company processes from the analysis of customer needs through delivery of the product/service and identification of resources and capabilities which the company needs to upgrade. The learning and growth perspective enables the organization to ensure its capacity for long term renewal which is a pre-requisite for survival in the long-run. The company not only considers what it needs to develop and maintain know-how, but also how it can sustain the necessary efficiency and productivity of the processes. This perspective comes from three sources; people, systems and organizational procedures.

The aim of balanced scorecard is to provide management with a concise summary of the key success factors of a business and to facilitate the alignment of business operations with the overall organizational strategy (Amarantuga and Baldry, 2000). The model also enables organizations to increase economic value through revenue growth and/or productivity. This model can be devised into a facilities performance evaluation framework; especially of buildings. The strength of the balanced scorecard lies in the fact that organizations do not have to choose between financial and non-financial measures. The model advocates that no one measure can provide a clear view of the company (Kaplan and Norton, 1996). Again, the traditional business management and accounting models are understood by few and sometimes hard to motivate changes in today's organizations. This model can be used not only as a strategy at all levels in the organization but also as a management tool for running organizations. Against this backdrop, the development of a building performance evaluation model for this thesis will be guided by the balanced scorecard model.

2.10.2 The Process Model

The process model was developed by Preiser, Rabinowitz and White (1988). This model outlines three levels of effort at which a building performance evaluation can be undertaken namely; indicative, investigative and diagnostic levels. Beside these three levels, the process is further divided into three phases and nine steps irrespective of the level of effort as shown in Figure 2.4

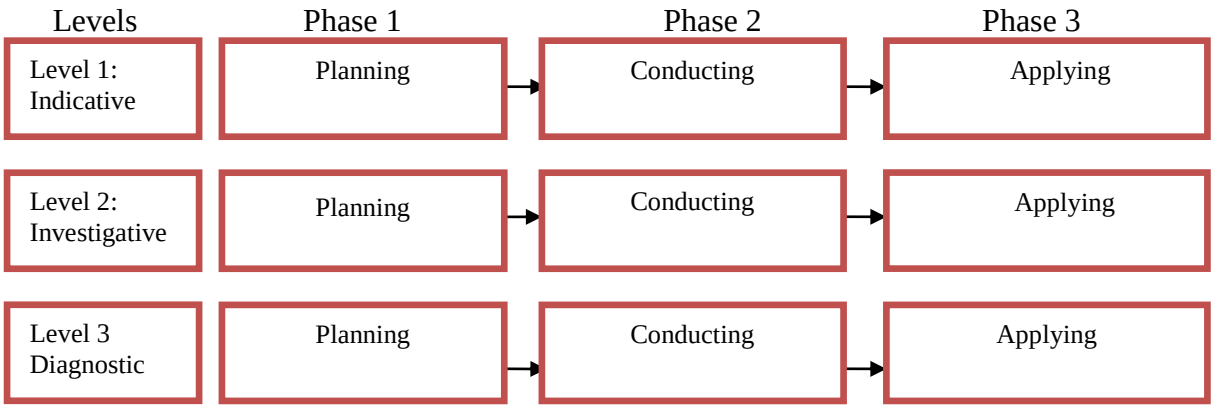

Figure 2.4 Process Model

Source: Preiser *et al*. (1988).

Details of the phases and levels in Figure 2.4 are illustrated in Table 2.3 as follows:

Table 2.3: Details of the Process Model

1.1 - Reconnaissance and feasibility	2.1 - Initiating on site data collection	3.1 - Reporting findings
1.2 - Resource planning	2.2 - Monitoring and managing the data collection process	3.2 - Recommend action
1.3 - Research planning	2.3 - Analyzing data	3.3 - Reviewing outcome

Source: Preiser *et al.* (1988).

Preiser *et al.* (1988) further identified three levels of performance at which the evaluation of buildings can be considered, namely;

- The health/safety/security level;
- The functional/efficiency level; and
- The social, psychological, cultural and aesthetic level.

The three levels of effort proposed in the model are selected based on finance, time, manpower and the required outcome. However, each level requires the same procedures of planning, conducting and applying. The indicative type is a quick walkthrough evaluation involving structured interviews with key personnel, group meetings with end-users as well as inspections in which both positive and negative aspects of building performance are documented. This provides an indication of major successes of a building's overall performance. The investigative type is more in-depth and therefore utilizes interviews and survey questionnaires in addition to photographs/video recording and physical measurements.

It typically involves a number of buildings of the same type. It is used where a problem has been identified during an indicative evaluation and findings presented in a report that identifies the specific problems studied and recommendations. The diagnostic evaluation is a focused, longitudinal and cross-sectional evaluation which studies such performance aspects as stair safety, orientation and way finding, artificial and natural lighting, privacy and overcrowding. It is aimed at improving not only the particular facility being evaluated but also to influence future design of similar facilities. Typically, it follows multi-method strategy including questionnaire surveys, observations and physical measurements. All these allow for comparisons to be made with other facilities.

The results drawn from such research are long-term oriented and can be used not only to improve a particular facility but also to improve a specific building type. The process model as developed by Preiser *et al.* (1988) has practical applications and therefore relevant to this study especially in the development of the methodology for the study.

2.10.3 Building condition and students' achievement model.

This model was developed by Cash in 1993 to show some possible factors that affect the building condition and in turn affect student achievement and behaviour (Mutlag, 2002). Cash (1993) states that leadership and finance influence maintenance and custodial staff (facility staff) which in turn have a corresponding effect on school building condition and performance. Again, building conditions influence attitudes of students, teachers and parents. The attitudes of teachers particularly influence the students' perception of the building which affects both academic achievement and behaviour of students. This relationship between building condition and students' achievement can be linked to various factors such as temperature control and ventilation, adequate lighting in relation to the space, aesthetics and colour. Mutlag (2002) illustrates Cash's (1993) model as shown in Figure 2.5.

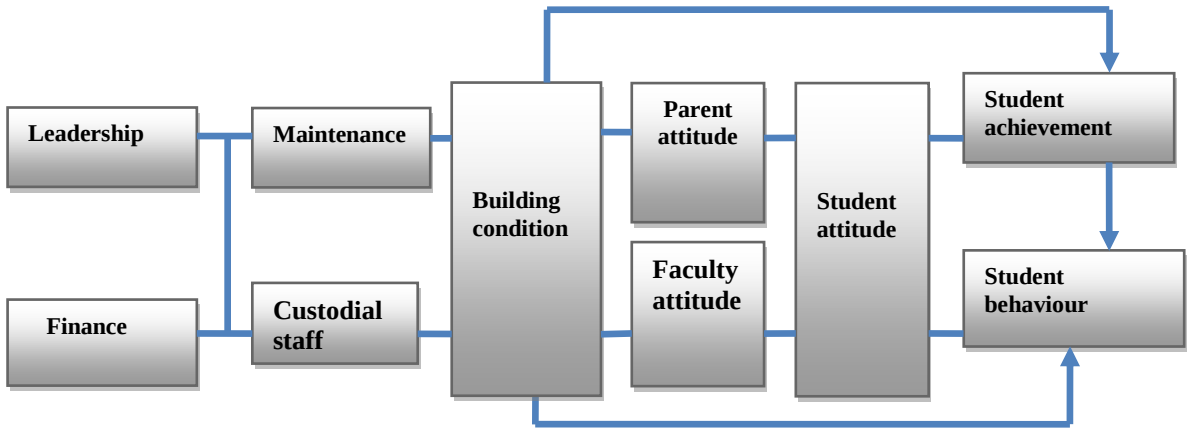

Figure 2.5 Cash's model of direct and indirect relationship between building condition and student achievement
Source: Mutlag (2004)

The variables identified in Cash (1993)'s model provide the evidence that supports this model's importance to the performance evaluation of educational buildings. However, the range of variables identified in the model is narrow. It did not consider factors such as budget

priorities, management decisions, adequate facilities staff and training which also affects building condition and students' performance.

2.10.4 The school building assessment model

This was developed by Sanoff in2001 as an assessment tool for existing or construction of new school building facilities. It is a collection of survey and discussion tools that encourage stakeholders in education (facilities managers, administrators, teachers, students, communities, designers and engineers) to discover and reflect upon the physical features of school buildings. Sanoff (2001) states that the purpose of the model is to identify what works and what does not work in a school building. Sanoff (2001) identifies five methods of assessing school buildings; each incorporating key elements to be considered in the assessment as shown in Table 2.4

Table 2.4: School building assessment methods.

Methods	Key elements/ components
Six factor School Building assessment method: A walking tour.	Context, massing, interface, way finding, social space and comfort.
School Building Rating scale	Physical features, outdoor areas, learning environments, school areas, media access, transition spaces and circulation routes, visual appearance, safety and security.
Photo Questionnaires	These capture the physical features and feelings such as interesting or boring, static or dynamic, inviting or repelling, common or novel, pleasant or unpleasant, friendly or unfriendly, like or dislike etc.
School Building Observation form.	These are statements about appearance and physical facilities such as walls, graffiti, pictures , flexibility, adaptability, furniture, convenience etc.
Wish poem	Consists of a group of statements composed of responses to phrases. Wishes of students, teachers, parents which represents a profile of school community's desires.

Source: Sanoff (2001).

Sanoff (2001) asserts that the assessment method provides a series of checklist questions and a rating scheme upon which each factor or element is evaluated. The process requires comments to supplement the factors prescribed in the checklist and any building or group of buildings is amenable to such evaluation. This, Sanoff (2001) calls the six-factor assessment method. The six-factor assessment method allows one to focus on six key elements of building assessment, namely; context, massing, interface, way-finding, social space and

comfort. These elements are evaluated qualitatively to determine the extent to which they meet the demands of a learning environment.

The school building rating scale is a qualitative assessment tool organized into categories which are essential components for meeting the demands of a learning environment. These include physical features, outdoor areas, learning environment, social areas, media access, transition spaces and circulation routes, visual appearance, safety and security. The building users then rate these components based on a continuum from very unsatisfactory (vu) to very satisfactory (vs). Numerical ratings are then used to assign a score to each factor or element being evaluated. Some of the information gathering or collection tools in this process include direct observation, interviews, simulation, questionnaires and walkthrough. Since this assessment is based on qualitative impressions, perceptual differences are bound to occur between staff and students. Sanoff's (2001) assessment tool is relevant to this study, especially in developing the methodology for the research.

2.10.5 Programme on Educational Building (PEB) organizing framework for evaluating quality in educational spaces/facilities.

This framework is the product of experts participating in the 2006 meeting of the Organization for Economic Co-operation and Development on evaluating quality in educational facilities (OECD, 2006). The framework consists of two dimensions; the first dimension addresses how quality is defined within the context of policy issues and the second dimension presents important characteristics in the process of evaluating aspects of quality in educational facilities. The relationships between these dimensions are shown in Table 2.5

The evaluation tools for these assessments include questionnaires, focus group discussions, walkthroughs, interviews, and observations while the quality of evaluators provided by the framework include researchers, space and asset managers, staff, students and educationists.

Table 2.5 PEB organizing framework on evaluating quality in educational spaces

Link between education policy and education facilities	Principle of Quality	Criteria of Quality	Points of evaluation in the building cycle
Increase access and equity to education (space provides equitable access to and adequate capacity in relation to demand).	Fit for purpose (relating to the benefit of the space to users).	Accessibility to all and student capacity (space is accessible and makes provision for students with special needs, structure is easy to understand and adequately supports current and projected student enrolment).	Pre-design, design, Construction, 12-24 Mo after initial Occupation any Critical stage during The building's use.
Improve educational effectiveness and promote acquisition of key competencies (space supports flexible and diverse teaching and learning programmes and pedagogies		Learning spaces, comfortable spaces, new technologies, social spaces, staff spaces and community use (spaces are flexible, of sufficient size and allow students and teaching staff to work).	Criteria of Quality
Optimize building Performance, operation and cost effectiveness (facility satisfies performance and operational requirements and demonstrates long term cost effectiveness)	Symbolic, visually Pleasing and offers Learning opportunities. Fit for purpose (relating to the facility's operational layout)	Space displays unique character through its design, visually pleasing and offer learning opportunity for the students. Initial investments, maintenance and repairs are cost effective, feedback loops, design selection, management and operation systems are effective.	
	Environmentally Sustainable	Site planning demonstrates environmentally responsible planning, sustainable systems	

Source: OECD (2006).

The PEB organising framework is a multi-dimensional policy-oriented tool that can help to discern the most appropriate means by which to evaluate different aspects of quality in educational facilities or spaces in different countries. It serves as a basis for the development of performance standards and measurable standards of quality for educational spaces. It further highlights the important role of quality facilities in increasing access and equity for all in education, improving educational effectiveness, promoting the acquisition of key competencies and optimizing building performance and operations.

The objective of the PEB organizing framework on evaluating quality in educational spaces is to show the inter-relationships over a facility's life cycle within the broad policy issues that shape and respond to quality in educational facilities (OECD, 2006:1). From the illustration in Table 2.5 the framework identifies three specific issues which reflect the contribution of quality educational facilities to key areas of educational policy, namely;

- Increased access and equity to education; which relates to the ability of the facility to provide equitable access to learning as contained in the "International Convention on

Economic, Social and Cultural Rights" (UNESCO, 2000; United Nations Office of the High Commissioner for Human Rights, 2002) offering adequate space capacity in relation to demand. This issue recognizes the fundamental right of all individuals to access to an educational institution and therefore addresses the issue of over-occupancy which can compromise the building users' comfort and safety and under-occupancy which can have adverse effect on the school character or philosophy;

- Improved educational effectiveness; relating to the facility supporting flexible and diverse teaching programs and pedagogies. It also promotes acquisition of key competencies by facilitating the interaction of individuals in socially heterogeneous groups; empowering individuals to manage their lives in meaningful and responsible ways by exercising control over their learning environment; and providing an environment that encourages students to use tools interactively. These key competencies are necessary for individuals to lead an overall successful life and for society to face the challenges of the present and future (Rychen and Salganik, 2003); and
- Optimizing building performance, operation and cost effectiveness; this ensures that the facility satisfies the performance and operational requirements of a school and demonstrates long term effectiveness.

Within these three broad policy areas, the framework defines five principles of quality and a number of criteria for defining the quality, namely;

- Facility must be fit for purpose in terms of accessibility to all including vulnerable and disabled users. The criteria for this include students' capacity; that is, learning spaces in terms of flexibility of classrooms, libraries, workshops and laboratories, comfortable spaces; for example, furniture, lighting, noise and temperature, new technologies, social spaces, staff spaces and community use.
- Facility must be symbolic, visually pleasing and educational; the criteria for this include issues such as aesthetic appeal and educational tools. Facility must be fit for purpose relating to operational layout; this refers to cost effectiveness, management and operational systems, feedback loops and design selection involving users.
- Facility must provide a healthy and safe environment in terms of portable water, sanitary facilities, fire safety, and lighting, secure design, safe finishes and safe vehicular and pedestrian traffic.

- Facility must be environmentally sustainable in terms of site planning, sustainable systems, methods and materials.

This framework provides a detailed view of the drivers of performance evaluation initiative within a facility management environment. It is therefore facilities intensive and adequately supports the aim and objectives of this research.

2.11 Chapter Summary

The construction industry in Nigeria has not fully developed its potential due to shortage of the requisite capacity to develop construction projects and under utilization of resources. The industry is also constrained by high cost of construction and difficulty in accessing credit facilities. Despite these shortcomings, several opportunities exist in the industry especially in education, and subcontracting sectors which makes it very attractive for investors. The education sector is in urgent need for improved infrastructural development especially building facilities to meet the demands placed on it. Modern trends in pedagogy demand a shift from staff teaching to student learning. This cannot be achieved without an effective facilities performance especially that of buildings. Indeed, no meaningful academic success can be achieved in an environment with dysfunctional building facilities.

The current expansion in higher education participation has generated an increasing and diverse student population in terms of academic preparation, capacities, motivation and interests. These pose tremendous challenges to the university system in terms of building infrastructure, funding and environmental concerns. The utilization of building performance evaluation as a facilities management toolkit could provide part of the solution to this challenge.

From the review of literature, there is a consensus of opinion among authors that building performance evaluation is built around the central theme of a simple statement; that it is a process of evaluating buildings in a systematic and rigorous manner after they have been built and occupied for some time. It means any and all activities that originate out of an interest in learning how buildings perform once they are built, including if and how well they meet expectations. This can be realized through a collaborative approach to the design and performance evaluation exercise. It is evident from the discussion that evaluation is a missing link in the building delivery process and for this reason; most buildings do not satisfy the

needs of the end user. If these needs are to be satisfied, a detailed evaluation and feedback mechanism must be put in place and frequently implemented.

The focus of this thesis is on the performance of buildings in educational institutions. These buildings form a significant part of infrastructural facilities, which is one of the major challenges confronting the university system in Nigeria. The main problem and sub-problems to be resolved in this thesis (highlighted in section 1.3) as identified within the context of the study include:

- Most educational institutions in Nigeria do not regard building performance evaluation as an area of legitimate interest; do not lay emphasis on the user-value of buildings and therefore procure buildings that are not adaptable, flexible and fit for purpose;

The sub-problems deriving from the main problem are as follows:

- Educational institutions do not lay emphasis on performance and user-value in the procurement of building facilities;
- Performance evaluation in educational institutions appears too trivial and does not fit into building procurement and funding stereotypes;
- A significant number of building facilities in educational institutions are not fit for purpose;
- Critical performance indicators/mandates are often absent in the design, construction and management of buildings in educational institutions;
- Building facilities in educational institutions are overstretched and inadequate for effective learning and teaching;
- There are no feedback mechanisms in the design and management of buildings in educational institutions;
- Building facilities in educational institutions are not adaptable and flexible; and
- There is poor perception and awareness of building performance evaluation among stakeholders in educational institutions.

Chapter 2 has discussed the general and contextual issues of the research. It also presented the highlights of the chapter and a recapitulation of the problems in the summary. In the next chapter, the theoretical framework for building performance evaluation based on the performance concept will be discussed. This will be mirrored through the theoretical foundation of facilities and value management.

Chapter 3: Theoretical and Conceptual Framework

3.1 Introduction

This chapter presents the perspectives that are central to the conduct of this research. It therefore introduces the variables of the research and the general framework for data analysis. One of the characteristics of a developed discipline is the presence of a sound theoretical base. This theoretical base guides the research, allows for prediction and increased understanding of the boundary criteria for the discipline (Bak, 2004:17). A theoretical framework refers to the structure which holds or supports the research theory (Palm, 2007:27). It assists in the development of a conceptual model of how one makes logical sense of the relationship among variables or factors that have been identified as significant to the problem under investigation. In this regard, the theoretical framework presents the theory that explains why the problems highlighted in chapter 2 exist and the body of knowledge in which the theory can be located.

3.2 Location of the theoretical framework

Building performance evaluation emerged as a result of the search for a systematic evaluation of the performance of buildings after they have been completed and occupied. The overall aim of using building performance evaluation is to generate feedback and to provide knowledge of how to improve both the building process and the management process. The result of this process has led to a better understanding of what the occupant really needs and more about how the buildings perform. Building performance evaluation therefore finds expression within the ambit of facilities management. Facilities management encompasses a vast spectrum of perspectives about people, organizations and change processes to realize organizational goals and value. Integral to this is the field of value management which is concerned with achieving value for money as it relates to buildings in use (investment).

These fields of research are very important to the construction and management of building facilities in any organization. For example, the learning cycle of facilities management is facilitated through a systematic programme of building evaluation. Building performance evaluation therefore is a key facilities management issue; it helps organizations to establish whether their facilities are supporting organizational goals and user requirements. This implies that an effective facilities management system is founded upon a robust building

performance evaluation programme. Similarly, since the term evaluation includes the notion of value, it is necessary to establish whose values are involved and what should be done in comparing or benchmarking outcomes. This is very important for effective facilities management and organizational growth. The key issue here is how to optimize value (in terms of contribution to bottom line) and at the same time maintain a high level of organizational effectiveness. This requires an optimum balance between people, physical assets and technology within the organizational environment.

From the foregoing, the theoretical framework for this research lies at the intersection of facilities management, building performance evaluation and value management. The underlying concept is performance. The issues relating to these fields of research will be discussed from the perspective of construction management and within the general principles of management. Figure 3.1 shows a graphical illustration of the location of the theoretical framework for this research.

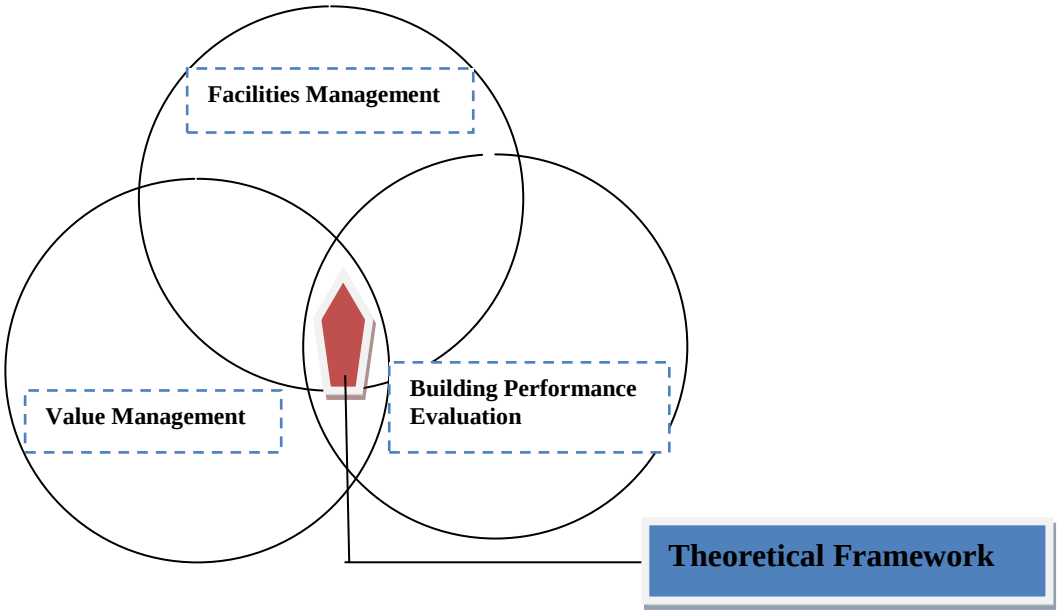

Figure 3.1: The position of the theoretical framework

3.3. The Fundamental Concepts

To better understand the issue of building performance evaluation, it is necessary to discuss some core or fundamental concepts underlying the theoretical framework. These concepts, apart from addressing the key issues in the research explain the relationships among the variables that constitute the greater part of this chapter.

3.3.1 Facilities Management

The field of facilities management and its links with building performance evaluation has been discussed in section 2.8 and 2.9 of this thesis. Nevertheless, this section further amplifies the issues discussed in that review. The consensus of the various definitions by authors (Spedding and Holmes, 2000; Atkin and Brookes, 2005; Amaratunga, 2000; Alexander, 2002; Preiser, 2002; Best, Langston and De Valence, 2003; Then, 2004) converge at the central idea that facilities management is not only about buildings, but also about people and the spaces they occupy in buildings and the processes they support; all operating within the ambit of available resources at the prevailing corporate culture. Buildings represent a substantial investment for organizations. They accommodate and support a range of activities within competing needs.

Besides, an organization's core business operates within the activities supported by buildings. Then (2005:304) states that with the emergence of facilities management, buildings are seen more as enablers to core business activities in an organization. No matter how well focused an organization might be on its core business, it cannot ignore the non core business (supporting services). It is therefore necessary to take an integrated view of both core and noncore businesses of an organization. Facilities management provides this view as it co-ordinates the running of the complex processes and activities of an organization whether public or private. Commenting on the nature of facilities management, Atkin and Brookes (2005:78) argue that facilities management is a more powerful concept than real estate or property management because it takes a holistic view of the dynamics of the workplace. Put differently, it takes a holistic view of the dynamics between people and processes and between people and the environment.

From the scan of academic literature on the practice of facilities management, it can be described as creating an environment that is conducive for carrying out an organization's core

business; taking an integrated view of the services infrastructure and using it to deliver customer satisfaction and best value. Facilities management is seen as a vector for change which must operate within a strategic framework to integrate operational decisions in an organization. Since this thesis is restricted to making contribution to the field of building performance evaluation within the framework of construction management, the most suitable definition is that provided by Amaratunga and Baldry (2000).

Amaratunga and Baldry (2000) define facilities management as "the provision of a selected range of largely building related support services to meet core business needs." This definition recognizes the fact that facilities management exists to support the core business of an organization. This implies that senior management must ensure that facilities are performing well if a good economic health of the organization is to be achieved. Atkin and Brookes (2005:152) agree with this view by describing facilities management as something that must support people in their work and other activities. Atkin and Brookes (2005) further outline what facilities management must do as:

- Enhance the well-being of individuals;
- Enable the organization to deliver effective and responsive services;
- Make the physical assets of an organization highly cost effective;
- Allow for future change in the use of space;
- Provide competitive advantage to the organizations' core business; and
- Enhance the organizational culture.

Whichever description is given to facilities management, the central issue to the practice is the departure from the conventional property management function (which focuses on the management of buildings and their functions) to the management of buildings for business and people. It is a strategic business discipline which adds real value to the organizations and not just a range of non core activities that are managed economically. Its scope is multi-disciplinary; spanning from facilities provision to facilities service management (Then, 2005:307).

3.3.1.1 The Scope of Facilities Management

The chartered Institute of Building (CIOB) describes the scope of facilities management as comprising five main groups of activities, namely; strategic property management, built asset

management, organization, people and processes, valuation and contract procedures or procurement. All the five groups take place within the practice environment. Figure 3.2 shows the scope of facilities management.

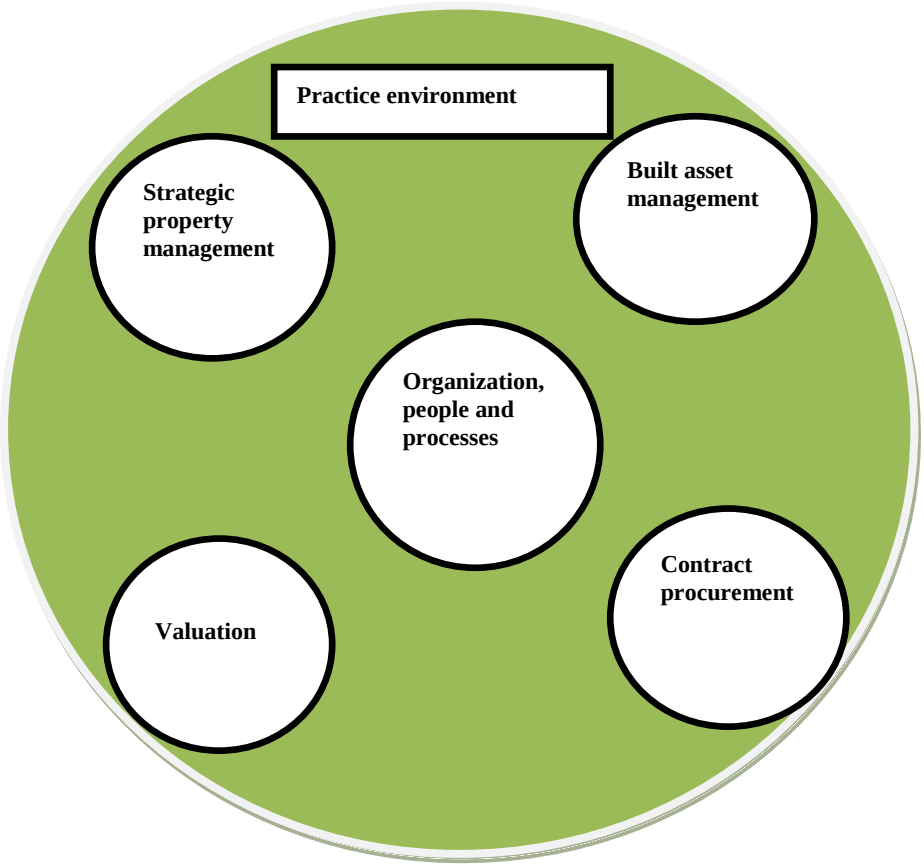

Figure 3.2 Scope of facilities management.
Source: (CIOB, 1996).

The scope of the discipline reflects a broad but interrelated resource base (investments, space, assets and people) which the facilities management practice must effectively manage to achieve the demands of the optimum business solution.

An essential tool for effective implementation of a facilities management strategy is building performance evaluation. When a facilities management unit/department in an organization lacks reliable and comparable data on building performance and costs, its ability to make basic decisions are impaired and this may put the organization at a significant strategic disadvantage (Amaratunga and Baldry, 2000). Facilities management has earlier been described as an organizational change agent. Building performance evaluation is part of that

change; it reflects the wear and tear a building undergoes and takes into account the varying uses and statutory demands placed on all buildings in a modern society. Management must therefore be reflective and strategic in planning and management. The inability to do this impinges negatively on performance.

3.3.1.2 Strategic facilities management and building performance evaluation.

In recent times, management is no longer seen as the controlling factor in organizations; rather it is seen as a function. Its task is to enable the organization's purposes to be defined and fulfilled by adapting to change and maintaining a suitable balance between the various and frequently conflicting pressures at work (Amaratunga and Baldry, 2002:328). Management can also be seen as the accomplishment of predetermined missions and objectives. It can be argued that management is concerned with achieving quality of performance. This implies that management performance is concerned with the manner or quality of managing. That is, the way in which management is done or how well management is done (Simpson, 1998; Hadjri and Crozier, 2009).

Towards the end of the nineteenth century, interest in the evaluation of performance had increased. From the classical management school of thought, there is need to evaluate performance in order to guide management decision-making. This perspective agrees with Danny (2003) who asserts that management covers key aspects of the facility portfolio and reflects the organizational directions and performance benchmarks. Danny (2003) concludes that management involves decision-making processes which affect the organization as a whole. Similarly, there is the human relations school of thought that sees the need to assess or evaluate performance necessary in order to establish whether an initiative is producing the benefits intended. Feedback involving performance evaluation is also shown as being the key concepts of the general systems theory (Obiegbu, 2004).

The above literature shows that the development of performance evaluation in management has followed a path that is influenced by a push to improve quality, service delivery and cost parameters. To achieve this, management must act proactively and strategically. It has been established that evaluation can affect the implementation of organizational strategies. Minzberg (1997:585) states that strategies are realized through consistency of decision-making; indeed, performance evaluation is an integral part of the strategic management control cycle in an organization. It provides information to management in terms of the trade-

offs between profit investments and also introduces individual strategic targets (Kaplan and Norton, 2000).

Thompson and Martin (2005:9-11) define strategic management as a process by which organizations determine their purpose, objective and desired levels of attainment; decide on actions for achieving these objectives in an appropriate time scale and frequently in a changing environment; implement actions and assess processes and results. They went further to say that whenever and wherever necessary, the actions may be changed or modified, the magnitude of which can be dramatic and revolutionary or more gradual and evolutionary. Thompson and Martin (2005) conclude that excellent implementation of strategies yield effective performance. The level of performance an organization achieves is a function of the efficiency and effectiveness of the actions it undertakes and thus, performance evaluation ensures that an organization pursues strategies that will lead to the achievement of high performance goals and objectives.

In the 1990s, literature on facilities management expanded to cover total integration of people, processes and places in the service of core business. This was brought about by progress in theoretical and empirical investigation of the business environment (Barrett and Baldry, 2003:20-22). In addition, facilities managers in organizations need to understand where their roles fit and how they can contribute to strategic developments and changes. These are key strategic concerns and therefore demand strategic thinking. Becker (1990) was a pioneer of what is now called strategic facilities management. Becker (1990) shows that facilities management developed out of the need for organizations to manage change. Becker (1990) states that information technology, global competition, high cost of space, and increasing employee expectations of the working environment are seen to be hampering organizational efficiency.

Becker (1990) further argues that facility management is not only about co-ordination but also about enhancing an organization; it ensures that facilities promote organizational objectives and goals. Becker (1990) considers the strategic aspect instead of the operational aspect as key to facilities management. Although Becker's view of facilities management as proactive and strategic is ideal, it is not common in practice. However, Becker's view adequately captures the role and scope of strategic facilities management.

3.3.1.3 Application of building performance evaluation to facilities management

Building performance evaluation can be applied to facilities management in several ways. Essentially, it is a method for data gathering on facilities performance. It is therefore useful for analyzing data and making recommendations for facilities improvements. The experiences of occupants and feedback from existing buildings have been ignored in the past (Cooper, 2001). The application of performance evaluation information to the building delivery process assist in closing the information loop in facilities management (Preiser, 2003). This is particularly useful when the evaluation results are fed into data bases focusing on building performance from the perspective of the user. An important feature of building performance evaluation is its emphasis on the ultimate customer/user and usable space. Facilities management applies the building performance evaluation measures as a tool for spatial efficiency. For example, space, as a performance measure can be used for measuring the functional worth of a building. Amaratunga (2000) states that three aspects of space must be considered when evaluating the spatial efficiency of a building facility. These include:

- Amount; in terms of area and volume;
- Quality; in relation to fit for purpose, visual and environmental attributes; and
- Shape; with respect to spatial configuration and layout.

A number of indicators can be applied to space from the building performance evaluation perspective. For example, the amount of usable space per employee which is useful for effective space planning and management. According to Palm (2007:43), space planning, budgeting and management are key components of any facilities management system. The space budget is established by determining the demand for space in a particular organization based on the requirements of the client and the projected number of staff. In this context, the values of building spaces even have precedence over physical building performance.

3.3.2 Value Management

In their effort to achieve greater efficiency, organizations are increasingly requiring that new building projects represent value for money. They are therefore seeking greater involvement in the building design process. This is to ensure that the building performance requirements are fully understood by the design team. Yu, Shen, Kelly and Hunter (2005) define value management as a structured and analytical process which seeks to achieve value for money

by providing all the necessary functions at the lowest cost consistent with the required levels of quality and performance. It is a very effective tool for meeting the increasing demand for value enhancement by clients. Advocates of value management argue that it ensures the provision of the required functions at a minimum cost without sacrifice to either quality or performance. Green and Moss (2000) agree that the value management approach to the building delivery process facilitates a systematic identification and clear definition of client requirements, increased understanding of the various stakeholders' objectives and effective accomplishment of building functions.

In order to improve the value of constructed building facilities, the value management studies maintain significant links with building performance evaluation. To understand the nature of this link or relationship, it is necessary to explain the concept of value. The word value is derived from the French word 'valoir' which means worth, usefulness or importance of a thing (Lomash, 1997). Value is established by comparison and for anything to have value, it must satisfy some desire or be conducive to some purpose. Value therefore can be viewed from different perspectives depending on the context. Value management primarily focuses on economic value which can be classified into four major categories. These include cost value which is the amount of money required to produce a product or provide a service; exchange value which is a product demand at a given time against its availability; aesthetic value which occurs when a product is in high demand due to beauty, social custom or rarity; and use value which is when a product is needed due to a particular or group of desired functions it can perform (Lomash, 1997; Onyeador, 2007:22).

Value can be maximized by accomplishing essential functions at minimum cost. Green and Moss (2000) state that the value management approach to building evaluation lays emphasis on cost and function. This implies that it does not only analyze the cost of a product or service but also the need for a product or service due to a particular or group of functions it can perform. A major function of value management is to develop the sensitivity of the building designer towards functions and costs. This can be achieved through design decisions based on information from performance evaluation. Atkin and Brookes (2005) argue that the focus of value management is value for money as it relates to buildings in use. Its role is to aid design decision making in general and the briefing process in particular. Atkin and Brookes (2005) maintain that the application of performance evaluation to value management studies promotes a systematic search for solutions that provide greater cost effectiveness

without compromising function or service. Through the evaluation of buildings in use and feedback of data into value management studies, it is possible to establish a cycle of learning within an organization. This cycle of learning, which is a long term on-going process, enables an organization to implement policies for progressive improvement of building performance (Barton, 2000). It is logical to argue that the role of value management and building performance evaluation towards an effective facilities/building delivery system is complementary. The full potential of the two research fields lie in their integration into a wider on-going organizational learning cycle. This approach encourages organizations to think more carefully about their accommodation needs and take well informed facilities management decisions.

3.3.2.1 Value Management and Performance data

Pressures on organizations are ever present to control costs. More so, where building facilities are seen as overheads on business operations. But understanding the role of buildings and how they can be effectively deployed in the context of business operations makes a case for their contribution to organizational goals and objectives. Onyeador (2007:32) opines that the business case for identifying the value added by building facilities in an organization is justified by the utility of value management studies. Value management looks at the ways in which value can be added to an organization and suggests that if building facilities are utilized effectively, they can help meet business objectives.

However, the purpose of performance evaluation is to provide data for building improvements. The availability and use of performance data helps to reduce those failures that occur repeatedly but could be fixed at the planning and design stages (Green and Moss, 2000). This can be achieved through data generated from performance evaluation and integrated into the value management studies. Different users within an organization have different perceptions of what should be the function of buildings. These perceptions, according to Green and Moss (2000) may be poorly defined and can change over time. The development of value management studies addresses these poorly defined perceptions which characterize the early building design processes. Performance data play a vital role in framing these perceptions into the value chain of organizations. Yu *et al.* (2005) report that although value management studies provide a framework within which user needs are made explicit at the early stages of the design process, it is important to recognize that design objectives/functions are only as reliable as the information on which they are based. This

implies that the quality of value management studies depends on the degree of reliability of performance data from building evaluations.

Generally, value management studies can be applied at all phases of the building life cycle; starting from planning, procurement, maintenance and management to disposal. This shows that the process impacts on everyone (clients, users and designers) associated with project delivery. Clients are most often concerned with achieving value for money from their building investments; users are concerned that the project meets their needs as closely as possible and designers are expected to meet the expectations of both the clients and the users (Barton, 2000). In addition, the designers must comply with the relevant standards and performance criteria. According to Barton (2000), building projects with complex issues may call for decisions to be made using inputs from these key stakeholders. The value management studies provide a platform for resolving such competing interests by relying on performance data derived from evaluated buildings. In some cases, it may establish priorities among a number of contentious items. Thus, providing participants with a better understanding of the perceptions of other stakeholders and the organization as a whole.

Atkin and Brookes (2005:7) agree that value management studies address design complexities and provide potential solutions. Atkin and Brookes (2005) maintain that when the value management process is conducted at an early stage of the building life cycle, maximum opportunity for value improvement is available. An added advantage is that the client, end user, designer and other key stakeholders participate in a facilitated problem sharing exercise; sharing knowledge and understanding of performance and best value. The primary audiences for data generated from building metrics are value management consultants and project cost decision makers. The availability of these data provides them with greater control over the overall cost control of the building facility. This implies that the best time to try and improve value is at the conceptual stage of the building delivery process.

3.3.2.2 Measurement of value in building facilities

The value added to an organization through decisions on physical facilities may sometimes be difficult to determine. They may be direct and immediate or indirect and lagged (Green and Moss, 2000). The direct value impact, for example, may be the selling of a building which results in cash inflow to the organization, while the indirect or lagged value added may be the selection of a workplace that increases employee morale, satisfaction and productivity.

The metrics used to determine the contribution of building facilities to an organization are primarily based on cost reduction or capital minimization. Often, organizations do not recognize the fact that buildings can help to improve revenues. Buildings contribute to improved revenue by avoiding costs and enabling people in the organization to improve their services and consequently increase revenues (Moss and Alexander, 2007).

The balanced scorecard model (Kaplan and Norton 1996) clearly explains how building facilities add value to an organization (see Figure 2.3). The model shows how organizations can increase economic value through revenue growth and/or productivity. The revenue growth comes from new markets, new products, new customers and expanded sales to existing customers. The productivity comes from reduction in expenses and efficient use of resources. The balanced scorecard's view demonstrates that building facilities can add value through growth and profitability (Burns, 2002).

Most organizations only consider how property decisions can improve profitability and add value to the organization through space or spatial efficiency, cost reduction and capital minimization. Measuring the value of these contributions is easy to calculate. However, measuring the value of building facilities' contribution to the organization is much more difficult than calculating the financial return. Burns (2002) argues that the output or contributions of buildings are internal; usually from one part to another part of an overall process. Furthermore, different organizations demand different results or outputs from their building facilities. This makes it difficult to have one indicator of good performance due to its subjectivity. This calls for the development of appropriate methodology or evaluation system that is not only valid but reliable enough to match the organizations' objectives. That methodology must be chosen within the limits of available data and resources. Details of this will be discussed in subsequent sections of the thesis.

Facilities management organizations must choose potential measures and strategies that are practical and appropriate to their core business objectives and within available information. This will provide the facilities manager with the appropriate framework that is easily explainable to top level management as well as justify the potential of building facilities to add value to the organization. The facilities strategies chosen by the organization depend on the broad core business strategies and objectives. Core business strategies and objectives such as revenue growth and productivity require the development of an evaluation system that

evaluates how well each strategy is adding value to the organization (Lindholm, Gibler and Levainen 2006). Lindholm *et al.* (2006) suggest that a measurement system that focuses on the stakeholders' needs and a balance of financial and non financial measures should be developed by the organization. The measures must be valid, reliable, practical and relevant. For example, in the measurement of employee satisfaction with the workplace; such measures as space per employee, physical condition of the building and client satisfaction with services are commonly evaluated. This will facilitate a proper identification of solutions in the value management process.

In a study on how building facilities/property decisions can create or add value to the core business in an organization, Moss and Alexander (2007) report that building facilities can add value through the provision of a pleasant and productive physical workplace. Another is by providing a responsive and high quality property services to the internal staff/customers. To facilitate the creation of value, organizations must formulate building facilities strategies capable of increasing revenue growth and productivity. Moss and Alexander (2007) suggest that such strategies must consider:

- The promotion of marketing sales;
- Increase in the value of assets;
- Increase in employee satisfaction;
- Increase in productivity;
- Increase in flexibility; and
- Reduction of costs.

In formulating these strategies, the organization must balance the tangible and intangible contributions of buildings to the organization. For example, facilities strategies such as cost reduction must be balanced with such less recognized strategies as increasing innovation and flexible workplaces. Most organizations rely on the traditional cost per square meter for performance measures. This is inadequate; the modern trend is to consider the evaluation of intangible measures such as employee satisfaction with the workplace to supplement the tangible measures such as costs (Groome, 2009). This provides a holistic view of the contribution of building facilities to the value chain of the organization

3.3.3 Building performance evaluation

The background to building performance evaluation has been discussed in section 2.4 of this thesis. It has also been summarised in section 2.11 that building performance evaluation is built around the central theme of a simple statement; that is, a process of evaluating buildings in a systematic and rigorous manner after they have been built and occupied for some time. This implies that building performance evaluation involves all activities that originate out of an interest in learning how buildings perform after completion and how well they have met the expectations of users. Feedback or lessons learned from this exercise can be used to improve future designs or fine tune the performance of existing buildings. Building performance evaluation provides an insight into how buildings and services support and frustrate the activities of users (Watson and Thompson, 2005). It is valuable in assessing building quality, particularly in terms of suitability or fitness for purpose. This is an important aspect of building facilities planning and management and can assist organisations to demonstrate that investments in buildings are being managed responsibly and with a view to achieving organisational efficiency. .

The basic understanding of building performance evaluation is that it is built around the performance construct. As a fundamental concept of this study, it is core to the understanding of the study context. This implies that the underlying issue in any building performance evaluation exercise is the performance outcomes from the technical, occupier/users', financial, operational and environmental perspectives (Leaman *et al.*, 2010).

In view of the discussions of the theoretical framework, it is clear that the facilities management view of buildings is that they constitute an important resource which enables organisations to effectively perform their core business or functions. It is also seen that the major aim of any building project is to add value for users. The concept of value management recognises this by seeking the contribution of parties involved in the building delivery process in creating value. Value management therefore maintains significant links with building performance evaluation by providing a platform for resolving conflicting interests arising from previous building evaluation activities.

However, to provide a clear understanding of the conceptual framework for the operationalisation of the theoretical structures (facilities management, value management and building performance evaluation) of this study, the following sections are presented.

3.4 The conceptual framework

A concept is an image or symbolic representation of an abstract idea**.** In this context, it is the researcher's position on the research problem and further shows the relationships that exist between different constructs that the study intends to investigate. The conceptual framework therefore gives direction to this research. Based on the theoretical framework discussed in the preceding sections, the performance concept is chosen as the conceptual framework for this thesis. The coming sections present this concept and the related variables and constructs.

3.4.1The Performance Concept

Generally, the concept of performance is used everywhere and applies to everything including the manufacture of cars, people or group benchmarking, business analysis, human resources and consumer advocacy. In all these, according to the Performance Based Building Thematic Network (PeBBu) (2005), they define and compare aspects of required target performance to real performance delivered. The performance concept covers many topics and criteria which can be categorized as physical, functional, environmental, economical, psychological and social. These aspects are related to a singular project according to the situation and context (Szigeti and Davis, 2005).

In the light of the above complex reality of performance, no single definition will suffice. However, one can come to grips with the idea of performance as defining the requirements and fitness for purpose. The concept is central to the building performance evaluation process and can be applied or used for new buildings, existing ones leased or owned. It can apply to the whole or part of the building process including life cycle management process (PeBBu, 2005). The underlying principle focuses on what a building is required to do and not prescribing how it is to be constructed. This implies that the completed building is evaluated to determine whether the design objectives are realized in terms of user needs and expectations.

The focus of this research is on the user and this provides a common denominator to an evaluation that is inclusive of all interested parties or stakeholders. It is predominantly about field studies, visiting and studying real buildings in use and talking to real people within the study context. Robson (2002) describes this as real world research. The study adopts the case study approach and utilizes the performance concept to answer the research problems. The validation and verification of results against performance targets are done by the triangulation

of methods. The underlying methodological issues addressed in this thesis are discussed in chapter 4.The conceptual framework describes the dynamic interactions between buildings, users and organisational processes. The nature of this interaction determines the extent to which the building performance hinders/enhances the activities of the user and organisational effectiveness.

The variables considered in the evaluation process include functionality, accessibility, productivity, cost-effectiveness, aesthetics, flexibility and adaptability, health and safety, security and environmental concerns. These variables have been discussed in section 2.5 and can be categorised as physical, functional, environmental, economical, psychological and social aspects of building performance as earlier stated. Building performance therefore depends on the extent to which the building meets the expectations of the user in terms of the above measures. The evaluation of these measures involves the collection of both quantitative and qualitative data. The balanced scorecard (BSC) model which measures both financial and non-financial aspects of performance is devised to capture these measures.

The development of a conceptual model for this thesis based on the balanced scorecard is discussed in section 4.9.1. The conceptual framework is therefore located at the intersection of building performance evaluation and the balanced scorecard model. Figure 3.3 shows the location of this framework and so provides a synoptic view of the research within the case organisations/case studies.

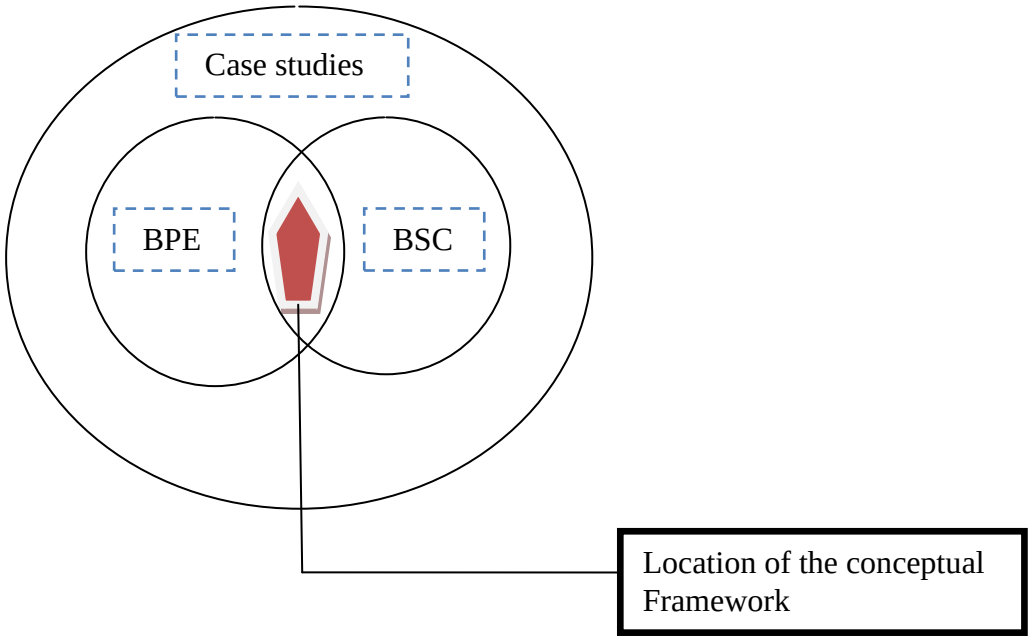

Figure 3.3 Model of the Conceptual framework

3.4.2 Development of the performance concept

The development of the performance concept can be traced to King Hammurabi of Babylon who reigned from 1955BC to 1913BC in the present day Iran. As part of his famous code of laws, King Hammurabi provided very stiff penalties including death for a builder whose structure wholly or partially failed. Part of what King Hammurabi said in article 229 is as follows:

> *The builder has built a house for a man and his work is not strong and if the house he has built falls in and kills a householder, that builder shall be slain*.

Clearly, this statement addresses the end result of the building in terms of user requirements. According to Gross (2002), this is a performance statement despite the fact that it only addressed an aspect of user requirements which is structural safety. It cannot be described as prescriptive because it did not say anything about the thickness of the wall, the size and spacing of the structural members or the materials of which they are made. Nevertheless, King Hammurabi is credited with the first performance statement.

Since the days of King Hammurabi, history has demonstrated a continuous search for the performance concept in both industrial and commercial developments. Research efforts have been undertaken to understand and develop methodologies and tools for application in major building programmes for housing, educational facilities and office buildings. The activities of American Society for Testing and Materials (ASTM); International Council for Building (CIB); International Union of Laboratories and Experts in Construction Materials, Systems and Structures (RILEM); British Standard Institute (BSI); and International Standard Organization (ISO) in the various international symposia/conferences on the performance concept in buildings are part of this effort. Accordingly, many countries in Europe, Asia and the United States of America have developed performance based regulations and codes consistent with the contemplation of the famous code of laws. For example, the British Standards and Codes of Practice, the American National Standards, International Building Code, the Nigerian Building Code, Australian Building Code, Canadian Building Code and the New Zealand Building Code.

To understand the concept of performance in buildings, terms such as supply, demand and production help to explain the relationship between building occupants or users (demand) and

those who provide, maintain and operate building facilities (supply). Baken (2001:43) states that the performance based approaches to facilities provision have been recognized as a major incentive for consumer oriented buildings. Baken (2001) argues that the current trend is a demand oriented housing market which is fast replacing the supply oriented market. Due to the complexity of the performance concept, different interest groups in the construction industry (developers, designers, owners, builders, facilities managers and users) express it from different perceptions. These perceptions are often diametrically opposed, particularly with respect to groups on the supply side (designers, developers, managers and builders) and those on the demand side (owners, tenants, users and property consultants) of the project procurement (Obiegbu, 2005:15).

Whatever perception of performance is expressed by any group, the underlying issue in applying the concept is to ensure that prescriptive solutions are evaluated against performance requirements for compliance with end user needs. For pre-construction applications; the solution must be expressed in prescriptive terms for evaluation to take place and for post-construction applications; the construction itself provides the prescriptive solution for evaluation (Szigeti and David, 2005:11). The crux of it lies in the effective evaluation and improved performance of buildings. To deliver a good and effective performance, it is crucial for partners in the building delivery process to capture, understand and define user and stakeholder requirements or needs before they start thinking about solutions (Palm, 2007:27).

3.4.3 Performance Requirements and Language

Performance requirements provide a reference point for the effective performance of buildings as a complete product. The project team must be capable of predicting not only parts of the building but also how the building will perform as a whole when the parts are put together. Performance requirements provide the information that anchors on the performance concept. However, the nature and complexity of performance has been explained in section 3.4.1. To some people; it is a concept of qualitative aspirations for buildings without a systematic methodology for analysis and verification. For others; it is a concept which requires quantitative analysis and rigorous evaluation that at times discourages those who wish to use it when these tools are not available (Pham, Boxhall and Spekkink, 2006). This situation creates the problem of speaking different performance languages among users and clients (demand) on one side and partners in the building process (supply) on the other side.

On the demand side, users think in terms of functional concepts using user language related to the user's own operations. On the supply side, building partners and operators tend to think in terms of solution concepts using technical language. These differences and frame of reference makes it difficult to reconcile or match supply with demand in practice. In their study of the development of a conceptual framework for performance based buildings, Szigeti and David (2005) report that performance is based on two key characteristics, namely;

- The use of two languages; one for the user or client requirements and the other for the supply of performance requirements; and
- The need for validation and verification of results against performance targets.

The first characteristic (the two languages) comprises the language of demand requirements and the language of the required performance which has the capacity to fulfil the demand. Szigeti and David (2005) state that the language of the client is needed on the demand side while the language of the provider is needed on the supply side. The dialogue between the client and the supplier is best described by the hamburger model illustrated in Figure 3.4

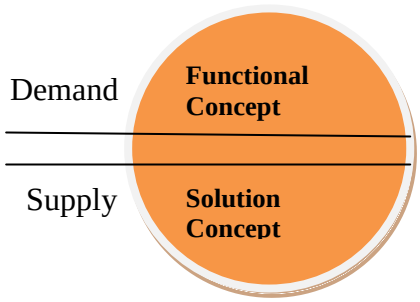

Figure 3.4 Demand and supply side of performance language

Source: The hamburger model (Spekkink, 2005:12).

The hamburger model shows the two halves of a hamburger roll with statement of the requirements in functional or performance language (functional concept) matched to a solution concept in more technical language and the matching verification /validation that needs to occur between them. The functional concept refers to a set of un-quantified objectives and scopes to be satisfied by the supply solution. The solution concept on the other hand refers to the technical materialization that satisfies the required performance

(Pham *et al.*, 2006). It must be noted that the development or selection of a solution concept is a design decision. Most design briefs do not adequately tackle this language problem and for this reason, building facilities often appear not to comply with the real user needs.

The introduction of the performance concept acts as an intermediary and therefore bridges the gap between the user and the supplier. According to Pham *et al.* (2006), the performance language brings about considerable improvements by offering an intermediate language that can match demand with supply. The relationships between these variables (user language or demand, technical language or supply, and the performance language) are illustrated in Figure 3.5.

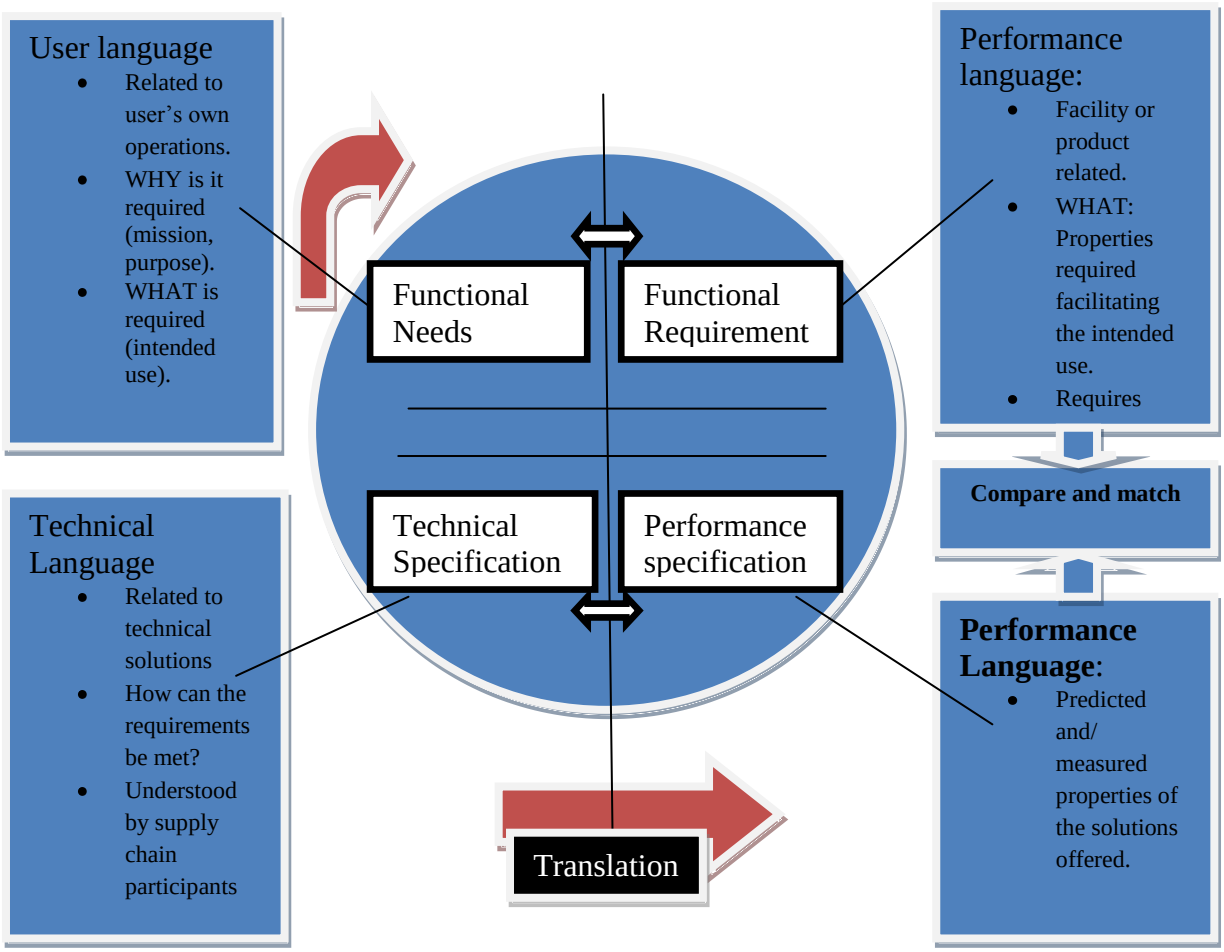

Figure 3.5 Relationship between performance language (intermediary), user language and technical language

Source: Pham *et al.* (2006).

A validation method by measurement, calculation or testing is necessary to evaluate the performance and compare alternative solutions. To compare effectively between the demand and supply, the use of gap analysis based on calibrated scales may be appropriate (PeBBu, 2005:11). The calibrated scale measures both the levels of requirements and the capability of the asset that is used, designed or on offer or leased. In this process, needs and intended use are translated into required performance and made explicit. This provides easy and transparent information for validation of the solution during commissioning or use of the building. User-functional needs and performance requirements whether explicit or implicit are embedded in building production documents prepared by clients. They may also be in the form of verbal statements that are communicated to suppliers. These requirements include information about what is essential to the client and can take various forms depending on who the client is, what the use is, what is being procured and at what phase of the project life cycle or supply chain the document is needed (PeBBu, 2001).

3.4.4 Performance questions and statements

Pham *et al.* (2006:8) report that some of the performance requirements or questions often asked by clients include:

- Did we get what we asked for?
- Can we measure/verify that what is produced or what we buy/rent meets our statement of requirements?
- We need fitness for purpose at a given cost; we need affordable and appropriate quality. No more, no less; and
- We need suppliers that are innovative and can respond or show us how what they offer will meet our requirements.

For building project teams, Pham *et al.* (2006:11) state that a performance requirement might provide answers to the following questions:

- What is the building facility for?
- Why is it needed and by whom?
- Is this a typical building? Or is this a unique project?
- Is the performance requirement intended for a new building, a renovation or alteration?
- What mission or objective does the building need to facilitate?

- What level of performance is appropriate in this situation and within what budget?
- Has an assessment been made of the building currently used by the intended users?
- What is the expected service life of the building?
- Are there some critical functions that need special support?
- What will be the initial project cost and expected life cycle cost?
- What are the predicted costs to occupy the facility in each year of the years it is intended to be occupied?
- Will the activities housed produce hazardous waste or other kinds of pollution? If so, what is required to deal with this situation?
- What impact will this have on the environment?
- What about the use of water and other resources?
- What kind of accessibility does the project require?

Clients can make informed decisions only when they really understand why they require what they want to procure and clearly and comprehensively state their requirements. Performance questions help to achieve this objective. However, at times when a project is commissioned and used, changes occur to its use; but if there is a well documented, explicit set of statements of requirements to support every stage of decisions, it will be easy to adjust to the changes and fine tune the facility in a manner that responds to the user's changed objectives. In writing a performance statement, Gross (2001:232-236) states that three essential aspects must be considered, namely;

- User requirements or needs: This is a qualitative statement giving the user need or expectation for the item being addressed. Simply put, it is a subjective statement of what the product or assembly is intended to do;
- Performance requirement or criteria/function: This is a quantitative statement giving the level of performance required to meet user needs or expectations for the item or product being addressed; and
- Evaluation method: This sets out the tests or other information upon which judgment of compliance or performance requirement is based. It identifies standards, inspection methods, engineering analysis, calculations, review procedures, historical documentation, test methods (laboratory, field, destructive or non-destructive) used in evaluating whether or not the performance requirement has been satisfied.

Gross (2001) maintains that performance statements also require standards, codes and regulations to facilitate communication and application. This should be produced on an international basis to obtain a consistent and comparable result. To help in the implementation of the performance concept, Gross (2001) outlines four useful components of the performance statement as:

- Commentary; which provides a background for the reader and presents the rationale behind the selection of specific user requirements, performance requirements and evaluation methods. Commentary is provided for information purposes only.
- Deemed to satisfy documents; which supply information on traditional solutions deemed to comply with the performance requirement. Deemed to satisfy documents help to implement the performance concept, particularly in regulations when traditional solutions have been shown to satisfy the performance requirements. These documents are sometimes referred to as codes of practice, manuals of acceptance, approved documents and prescriptive codes.
- Quality control manuals; which refers to those documents that set out the quality control and quality assurance procedures for building products. They also set out construction practices, laboratory accreditation and product certification programmes.
- Post occupancy evaluation; which outlines procedures for evaluation of the actual performance of the building in use. It provides a means of assessing actual performance as compared to predicted performance and feedback for the future work.

3.4.5 Performance standards

Standards are technical documents prepared to establish desired levels of performance whether by prescription or performance (Building Research Association of New Zealand (BRANZ) (2003). They are developed under a form of consensus with a representative range of participants. They generally deal with how things are to be done and often represent best practice or the application of a family of products at a point in time. Bukowski, Hirano, Radcliffe and Bowen (2001) list three types of standards as:

- Test or calculation method standards used to evaluate or measure the performance characteristics of designs, systems or products;
- Product or system specification standards which provide requirements for product or system configuration (prescriptive specifications) or performance characteristics; and

- Performance statement standards which comprise user needs or objectives, qualitative descriptions of performance needed to accomplish the stated objectives, parameters to define necessary performance level and methods for measuring achieved performance level.

Standards may be prescriptive or performance based. A performance based standard states goals and objectives to be achieved and describes methods that can be used to demonstrate whether or not products or services meet the specified goals and objectives. It focuses on desired characteristics of the final product, service or activity rather than requirements for the process to produce it. Performance based standards may also be referred to as objective standards. A prescriptive performance on the other hand typically prescribes materials, design and construction methods frequently used without stating goals and objectives. Prescriptive or performance based standards are needed to facilitate communication and application of the performance concept. However, the focus of the discussion in this section is on performance based standards. Hattis and Becker (2001:415) report that four goals define the development of performance standards for different building types. These include:

- To facilitate the satisfaction of user needs;
- To facilitate innovation by providing a systematic framework for evaluation and acceptance;
- To facilitate communication among all stakeholders in order to achieve rational choice of facility and products; and
- To facilitate international trade systems and products by replacing prescriptive standards that may serve as restraints.

The goal statement of a performance based standard should be a broad qualitative expression of the overall primary concern of the document. In this regard, goals may be stated in terms of impact on people, property or the environment, business interruption or any combination of these. Goals should be stated in terms that are potentially measurable even if the precise measurement scale is not specified. Hattis and Becker (2001:216) state that the overall goal for establishing a performance based code or standard is the creation of a framework for acceptance of alternative materials, design and methods of construction. It therefore allows for user flexibility in choosing materials, design and construction to meet the goals and objectives of the standards.

According to Bukowski *et al.* (2001) the advantages of performance standards include the encouragement of people to find optimum ways to meet performance criteria. It is efficient and requires less effort. Bukowski *et al.* (2001) further state that performance based standards allow for earlier use of new technology, clearly state goals and objectives which answer the question of what is to be achieved. This is opposed to prescriptive standards whose goals and objectives are at best implied and at worst unknown. For many rules in prescriptive standards, it is difficult to answer with certainty the question of what the end function to be achieved will be. The performance approach focuses on the building attributes.

This focus enlarges the field of building construction and delivery process to include whole new areas of research. Since human requirements are the defining parameters for the building attributes, their proper definition is required in the development of the performance concept. This process includes research on human response to the built environment covering such areas as physiology (for example, comfort), psychology (for example, privacy), sociology (for example, beauty or aesthetics), ergonomics and special populations (for example, the disabled). As mentioned in chapter 1 of this thesis, these issues are considered in the qualitative aspects of the research discussed in the research methodology.

3.4.6 Regulations and codes

Regulations are developed by a country's national government or delegated bureaux and may be promulgated nationally or adapted and adopted by a local jurisdiction (BRANZ, 2003). Perhaps, this is why the term regulation rather than code is often used. In some countries, for example the United States of America, the national government has no formal role to play in the development of codes and regulations. Private bodies develop codes which are eventually adopted by states or smaller government bodies. The codes are later adopted administratively or legislatively into law. It is after passing through these legislative adoptions that they become regulations.

In a study on the application of the performance concept in buildings, Adenaike (2004:15) states that Codes can either be mandatory through legislative references (for example, the Nigerian building code), or voluntary (for example, codes of practice). A voluntary code can achieve a high level of performance if it is acceptable to the community implementing it (BRANZ, 2001). For a mandatory code, the required level of performance will be determined by a complex mix of political and technical issues. However, whether they are regulations or

codes, these documents contain a mandatory requirement of what must be accomplished or provided under specific circumstances. This is where regulations differ slightly from standards. Bukowski *et al.* (2001) state that the difference between standards and regulations is that standards are developed by a broad range of public or private organizations and not by legislatures or their delegated bureaux. Standards are not usually adopted directly as mandatory requirements except where they are made mandatory references within regulations.

Codes and standards are linked in many ways. In broad terms, performance related standards employ a structure that is complementary to that of the codes. Adenaike (2004:17) states that codes have traditionally made references to standards which then provide greater level of detail on how a function is to be fulfilled or verified. In any case, performance standards and codes developed by most countries have similar objectives, functional requirements and performance requirements. According to Szigeti (2005), the objectives are at the top level of the performance concept. They state the society's, organizations' or individuals' demands. These demands include safety of occupants, enough space for people or minimizing the use of non renewable resources by an asset. Functional requirements or statements describe the function of the building or elements in meeting the overall objective and sub-objectives. A detailed performance requirement leads to the achievement of a good functional statement. In a conventional regulatory system, standards are usually incorporated within the regulations (by reference) as parts of mandatory provisions or as criteria to determine whether or not a regulatory requirement is met.

Nevertheless, with the movement in recent times towards a performance based regulatory system, the status of standards may change and are likely to give a more practical evaluation tool or compliance method to support specific requirements. It is important to note here that the performance characteristics of materials, products or systems can affect the performance objectives for multiple building attributes or user needs. It must therefore be recognized that when developing performance standards, these potential interrelationships should be considered. Bukowski *et al.* (2001) suggest that one way of addressing this issue is to develop a matrix of relationships between a standard set of building components and attributes that can identify materials, products or systems whose performance affects multiple attributes. This will facilitate a successful performance evaluation process, whether of a building or any other physical facility for that matter.

3.4.7 Key issues in the performance evaluation process

Performance evaluation is a process of ensuring that an organization pursues strategies that lead to the achievement of overall goals and objectives. It is a metric used to quantify the efficiency and/or effectiveness of an action (Amaratunga, 2000). Performance evaluation quantifies how well the activity within a process or the outcome of a process achieves a specific goal. It therefore guides the organization in the selection of appropriate techniques.

Performance evaluation is a well known term in the business world and in recent times regarded as one of the essential tools of business management. It is now common among companies to have yearly business reviews including the rating of staff performance and peer ratings. These performance reviews are based on performance targets explicitly agreed to at the beginning of the period under review. The essence of performance evaluation is to manage and more importantly to improve performance. Its push is driven by a well founded principle of effective and efficient use of business resources.

Then and Tan (2002:381-385) argue that a recent management drive has been for validating internal performance based on external comparative analysis. The initial focus of such comparisons is primarily based on financial parameters. This focus is not necessarily a balanced approach to the evaluation process because non-financial parameters also make significant contribution to performance. Barrett and Baldry (2003:76) support this view by maintaining that the objective of performance evaluation is not limited to optimizing running costs of buildings (financial parameter) but should include non-financial measures such as the design and management of spaces for people and processes to support the fulfilment of organizational goals and mission.

The message from this view is that performance evaluation is based on the practice of thinking in terms of goals rather than means. It therefore depends not only on measurability of variables but also on what factors are being considered and the methodology to be used. A good performance evaluation mechanism provides direct benefits to the organization by a rigorous and focused approach to the achievement of goals (Then and Tan, 2002). An important issue in the process is to understand what is to be evaluated. This is necessary to achieve the desired results. Szigeti and Davis (2005) report that a good building performance process must have three key aims:

- The subjectivity of assessment should be minimized;
- The assessment should provide a consistently reliable result when used on similar buildings; and
- The result should offer a meaningful indication of the building's total performance.

The need for performance evaluation in an organization has been acknowledged by many authors (Douglas, 1996; Amaratunga, 2000; Alexander, 2002; Barrett and Baldry, 2003; Then, 2004; 2005; Preiser, 2005). Buildings, whether owned or leased have been identified as a business resource and therefore regarded as a useful support to business ends. PeBBu (2005) reports that buildings, whether viewed from the perspective of end users or as a means of production are regarded as a business resource rather than overhead costs. Organizations must therefore pay attention to how this important resource (building) operates.

Clearly, the message again is that organizations must recognize the contribution of building facilities to the achievement of organizational objectives and business targets. To respond to changing business practices, the range and scope of services provided by buildings transcends merely providing technical solutions to business; rather it also impacts on the financial performance of the organization. Then and Tan (2002) agree that within an organizational setting, performance evaluation provides a basis for monitoring achievements from policy to outcomes (financial performance inclusive).

Then and Tan (2002) refer to what they called efficiency measures, effectiveness measures and appropriateness measures. These measures allow an organization to derive information from the past and evaluate contemporary trends in a manner that will provide the means for better planning and operation in the future. Measures aimed at monitoring efficiency are mainly concerned with the relationship between input and output variables while those aimed at monitoring effectiveness are concerned with the extent to which achieved outcomes are compared with stated objectives. At a strategic level, for example, the public sector; the appropriateness of chosen objectives against policy direction are evaluated. These relationships are shown in Figure 3.6

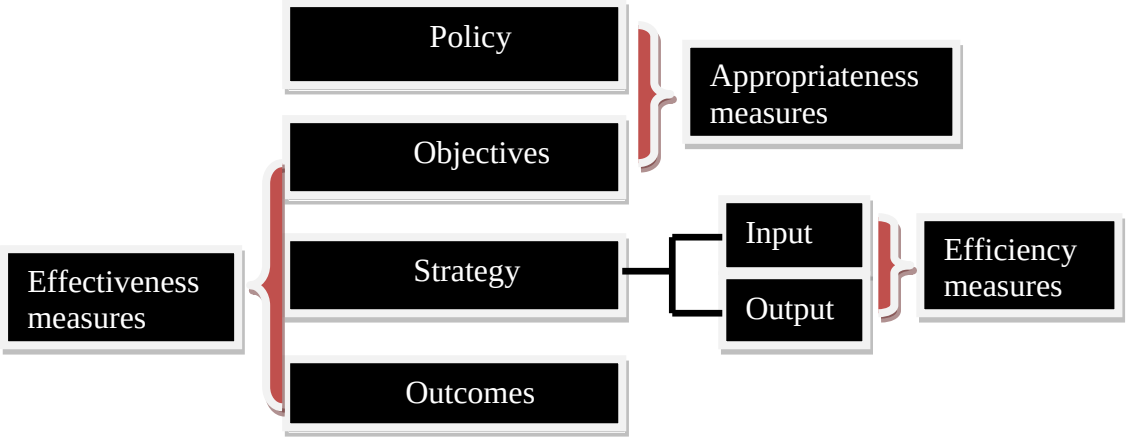

Figure 3.6 Performance measurements in the public sector
Source: Then and Tan (2002:382).

The benefits of performance evaluation are derived from the philosophy of comparative analysis as a continuous improvement tool (Okolie and Shakantu, 2009b). Within the practice of comparative analysis are the emphasis on understanding processes and ability to introduce change, meaningful measures and learning from external sources (benchmarking best practice). According to Barrett and Baldry (2003:77) performance evaluation can enhance decision making, influence and modify behaviour to improve consistency with operational goals, improve internal and external accountability, support strategic planning and allow the evaluation of resources used. The rationale behind the evaluation of building performance stems from the realization that construction costs are only a fraction of the overall costs of building ownership and that buildings are means to an end. This realization calls for a robust decision making tool that is capable of assessing the influence of different operations, maintenance and service usage strategies throughout the service life of the building on costs.

Then (2005) points out that if maintenance investment is inadequate or higher usage imposes greater stress or wear on a facility than is anticipated, the life cycle costs are likely to increase. Substantial expenditure on facilities support-services; including maintenance, repair and renewal work must therefore be optimized. This will maximize the value of the facilities over their operational life. In relation to buildings, Then and Tan (2002) posit that the development of a framework for performance evaluation must recognize three essential characteristics of buildings, namely:

- Buildings have much longer life than most other assets in business; they require high initial capital investment and subsequent running costs and reinvestment. Life cycle management is therefore required to optimize their operational efficiency;
- That a building's value is represented by its effectiveness as a supporting resource in the overall value chain of an organization's productive process. As an enabling resource, it is increasingly seen as a crucial factor in raising the productivity of staff. Besides, an integrated resource management approach incorporating the delivery of an enabling workplace environment must be acknowledged and adopted; and
- That the building's operational life may involve a number of owners, organizations, and users.

There is evidence from the review of literature in chapter 2 that these building characteristics can be grouped into four aspects of building performance evaluation, namely;

- The suitability of current building stock in meeting the objectives of business;
- A satisfactory working environment for occupants and customers;
- Minimization of operating and maintenance cost; and
- The performance of buildings as functional and operational assets.

The outcome of these four aspects of building performance must be balanced if an organization must optimize its building performance strategy.

3.4.8 Benchmarking best practice.

Today's business environment is characterized by rapid and constant transformation. This calls for improved competitive position for organizations. To remain competitive therefore and in tune with customers, organizations must not only be flexible but also adaptable in their overall business strategies. This implies that for an organization to adapt and align itself with recent developments in the external environment, it is very necessary to emulate or learn on a continuous basis. To meet this challenge, business organizations have adopted different tools, techniques and strategies to improve their operational performance and strategic positions (Wagner, 2007:12).

One of such tools is benchmarking and is fast becoming one of the most popular organizational tools for strategic decision making and business improvement in the world.

Shakantu and Talukhaba (2002) maintain that benchmarking of best practice standards can be used to achieve a competitive advantage in the present globalized industry. Benchmarking came to the fore in the wave of new management thinking and therefore designed as a tool to improve the fortunes of business organizations. In construction and property management, it has been adopted as a tool for supporting the process of continual improvement in product and service delivery.

The benchmarking process can be implemented to improve the performance evaluation of educational facilities. For educational institutions, this is an important strategic decision making function. In times of high cost of operations, increasing competition and user expectations, educational institutions must seek to maximize their return on investment in both people and facilities (Amaratunga and Baldry, 2000:293). Facilities, particularly, buildings are facilitators of educational performance; unfortunately, understanding of the performance of this resource has remained relatively underdeveloped. Anecdotal evidence shows that little data exists to assess how extensively the use of the benchmarking process is implemented particularly in educational institutions. However, it is not uncommon for benchmarking to be confused with best practice or performance evaluation in facilities management. It is therefore necessary to provide a working definition of these concepts in the review.

Generally, many definitions for benchmarking exist in business management literature. McCabe (2001:27-28) provides a methodological insight by describing benchmarking as a process of continuous improvement based on the comparison of an organizations processes or products with those identified as best practice. Carrick (2000:19) contributes to the above definition by stating that benchmarking is a system of comparative analysis that provides objectively developed information which helps businesses to know where they stand with competitors or industry leaders. Benchmarking thus provides a platform for supporting a continual improvement. Its objective is to identify current performance in relation to best practice in areas of concern to the organization.

Anderson (1999:287) defines benchmarking as a best-in-class achievement recognized as the standard of excellence for that business process. This shows that benchmarking is quality or performance focused, stakeholder driven and forward looking. Kohl (2008:3) provides a generic definition of the concept by stating that benchmarking is a systematic and frequently

continuous process for measuring own performance against best practice in order to identify improvement potential. From the facilities management standpoint, benchmarking is the identification of industry best practices that lead to superior performance, where data from individual facilities are measured against those from other comparable ones (www.fmlink.com/profResources/benchmarking).

In this regard, facilities professionals can compare not only their facilities operating costs to others but also see the differences in best practices which would help them to identify and justify what may need to be modified in their facilities. Atkin and Brooks (2005:159) define benchmarking as an external focus on internal activities aimed at supporting the drive towards best practice. Atkin and Brooks (2005) further argue that insights are gained by studying best-in-class organizations through objective comparisons. In this case, it is likely that the best practitioner is better because what it does is different. This provides a challenge and allows the organization to recognize and close the gap between its own performance and that of the best practitioner.

Whichever definition is used, what is important is to note that the key words in the above definitions are best practice, competitors and improvement. In essence, the competitors consist of any organization carrying out activities with similar characteristics or end products to the one that is being benchmarked. The main focus of benchmarking is to learn from others and gain insight into best practices or best buy that may improve organizational performance. However, within the facilities management discipline, there is a misconception that the tool is used mainly to compare and save costs.

This misconception prevails largely because facilities managers are pre-occupied with measuring occupancy costs which can be meaningless without proper regard to the underlying processes and cost drivers (Wauters, 2007). Benchmarking in this context should not be used simply to compare cost of services but where appropriate to measure the effectiveness of the processes that lead to those costs and at a given performance level. Besides, implementing the benchmarking process mainly to save costs may be misleading because doing so without taking processes into consideration may have detrimental effect on the quality of facilities management service delivery and subsequent higher costs in the long run. It is pertinent to note that whatever the reason to benchmark is, there is need to ensure that the process follows

the key principles which are always aimed at identifying best practice with the objective of emulating it.

There are different types of benchmarking. The Global Benchmarking Network [GBN] (2008) provides two broad categories; the informal and formal benchmarking. GBN (2008:5) defines informal benchmarking as an activity that encourages employees to learn from the experiences and expertise of other colleagues and organizations through comparing practices and processes. This can be done through, for example, best practice tours, conferences, best practice websites and networking. Most people do this type of benchmarking unconsciously at work and in everyday life. Formal benchmarking on the other hand is divided into two parts; performance benchmarking and best practice benchmarking. Performance benchmarking describes the comparison of performance data obtained from studying similar processes or activities. It compares performance levels of processes /activity with other organizations – therefore comparing against benchmarks. Best practice benchmarking describes the comparison of performance data obtained from studying similar processes or activities and identifying, adapting and implementing the practices that produced the best performance results.

According to GBN (2008:4), best practice benchmarking is the most powerful tool. It is used for learning from the experience of others and achieving breakthrough improvements in performance. It focuses on action; that is, making use of the data compared and learning why other organizations are performing better. Performance benchmarking identifies a performance gap but does not provide the solution to it. Most often the data is collected and no further action is taken but best practice benchmarking provides the solution on how performance can be improved and the gap closed. Other types of benchmarking such as internal, external, strategic, product and competitive benchmarking are subsets of either formal or informal benchmarking.

Earlier in this review, it has been stated that the choice of benchmarking varies between organizations, but the key issue is that the bench-marker should always concentrate on identifying best practices and finding ways to emulate it (Okolie and Shakantu, 2009a). Studies have shown that major business activities in many organizations are now implementing this tool to improve their operational performance and strategic positions. GBN (2008), a leading benchmarking network representing over 20 countries in the world initiated

a research to identify the status of the use of about 20 business improvement tools and how organizations are utilizing benchmarking benefits worldwide. The report shows that best practice benchmarking is one of the most likely tools to increase in popularity in the years ahead. The report further lists (in order of importance) the main benefits of benchmarking as follows:

- Improved performance of processes;
- Learning what other organizations are doing; and
- Addressing major strategic issues.

The survey shows that the most popular methods for collecting benchmarking data and best practice information are searching the websites, literature searches and site visits/meetings with benchmarking partners. An interesting part of the report is that 30 percent of the respondents who use best practice benchmarking indicated that over 60 percent of their projects resulted in implementing best practices within their organizations. However, the following deductions can be made from the reports:

- The prime benefit of benchmarking is improved process performance;
- Best practice benchmarking offer larger gains, though require more effort and time;
- Best practice benchmarking is an improvement tool which is increasing in popularity;
- Organizations are increasingly recognizing the value of benchmarking as a means of meeting the rising demands of customers and other stakeholders and so remain competitive in the global market competition;
- Some organizations are not obtaining the full benefits of benchmarking best practice due to lack of training, non compliance to benchmarking methodology or benchmarking code of conduct and not using standard project management practice; and
- There is an urgent need for facilities and business managers to acquire the necessary skills for effective implementation of best practice benchmarking.

The implementation of benchmarking of best practices has also been acknowledged in educational institutions. A case-study conducted at Canada's Capital University; the Carleton University (www.carleton.ca/qualityinitiatives) shows that out of 10 top improvement tools used in the University, benchmarking provides the highest level of satisfaction. The report also shows that the implementation of best practice benchmarking produced a tremendous

processes performance improvement in such areas as application for residence, managing custodial contract and services, managing construction project delivery, tuition payment, security and athletic facilities, creating healthy workplace culture, hiring, accessing courses, award administration and textbook adoption/ordering.

The National Consortium for Continuous Improvement in Higher Education [NCCI] (2008) reports that Carleton University has used best practice benchmarking for over 20 years and records a productivity improvement mean life of 8.3 years. The productivity impact reduced residence vacancy rate from 3.5 percent to 0.4 percent cycle time to respond to and accept applications to residence improved by three months; residence revenue increased by $400,000; completely eliminated line-ups at the business office and increased the percentage of total payments processed electronically from 59 percent to 77 percent. This case-study bears testimony to the fact that best practice benchmarking can indeed improve process performance and productivity in facilities management.

In another study, Stoy (2007) reports the application of best practice benchmarking by a property company (Migros) based in Switzerland. Using a portfolio of six buildings used for own operations, the company compared comparable properties based on identified property cost drivers and indicators. The application of the concept proved its value by increasing the company's share of the Swiss property market. As a function whose principal aim is the pursuit of best practice, benchmarking employs a fluid methodology that can be applied to virtually all types of organizations including educational institutions. In the search for the improvement of facilities performance, it uses performance criteria (Wauters, 2007).

Within the facilities management discipline, there is need for a framework such as that provided by the benchmarking process which can lead to firm decision-making information. This information can be utilized to implement change and optimize value for money. Best practice benchmarking can provide facilities performance evaluation standards that may guide facility managers in service delivery. When educational institutions are taken into consideration, they have perhaps, a wider range of building types and more diverse operational needs than most other organizations.

Evaluation may therefore be on such aspects of performance as functionality, productivity, cost-effectiveness, aesthetics or health and safety (Zimring, 2001). If a performance audit or

monitoring check identifies a building product or service as performing poorly, the facilities manager might decide to benchmark that product or service by first identifying what to benchmark within the product, then he/she considers other variables such as assets, inputs, processes and systems (AIPOS). Although information for an effective benchmarking process can be provided by a building performance evaluation technique, the benchmarked building product must be compared with identified industry best practices.

Put differently, buildings are evaluated to improve performance which in turn compares with competitors based on identified best practices. Best practice standards obtained from an effective benchmarking methodology can therefore provide the key for a better performance evaluation exercise in contemporary facilities management

Best practice benchmarking and benchmarking of best practice have been used interchangeably in this review. Generally, benchmarking is all about comparison with a best practice competitor where the primary aim is to emulate and not to copy. The prime benefit of benchmarking is improved process performance. Within the facilities management discipline, building performance evaluation can benefit from the evaluation standards obtained from it. Building performance evaluation systematically measures actual building performance with explicitly stated performance criteria usually documented in a facility program. Best practice standards obtained from benchmarking provides a guide against which this performance criteria or measures can be compared and improved. It further implies that benchmarking can be used as an indication of performance.

3.4.9 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, 2003:110). 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 data 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 key performance indicator can only be indicative of future performance.

Following the Egan (1998) report, the construction industry in the United Kingdom (UK) developed its own set of key performance indicators to measure performance. The report set specific targets for improvement and based on this report, the movement for innovation (M4I) and construction best practice programme (CBPP) were launched. These organizations help to clearly define the requirements needed to deliver targeted improvements. The CBPP is recognized as the leading organization involved in the production of KPIs within the industry and has been very successful in introducing companies to the subject of performance measurement/evaluation.

However, many organizations have their own agenda for key performance indicators, for example, The Housing Forum, Major Contractors Group and Design and Build Foundation in the United Kingdom and the National Universities Commission (NUC) in Nigeria. Another such organisation is the Architectural Practices Benchmarking and Construction Round Table. The successful application of key performance indicators depends on the extent to which they are integrated into the performance evaluation system. When developing the criteria/indicators for a performance evaluation system, a clear understanding of the different types and their application is required.

Different criteria/indicators are therefore required for different building types. Reviewing the key performance indicators in the UK construction industry, Beatham (2003) reports that managers need to differentiate between key performance indicators (which is indicative of associated future performance), key performance outcomes (which measures completed events) and perception measures (which is the individuals' judgments). In applying these measures, managers must ensure that evaluations are holistic, including a mixture of leading and lagging indicators. Evaluations must also give early information to assist managers in the decision making process. Beatham (2003) concludes that performance evaluation systems must include all types of measures aligned to the individual organizations' objectives and strategies. This must be used to initiate change action driven by results. A performance indicator therefore helps an organization to define and evaluate how it has succeeded in achieving its long term organizational goals.

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.

For a public service organization with a social mission, small incremental improvements are maintained across a complex range of performance indicators. For an organization with a commercial mission, the indicators are more easily quantified and controlled because the organization has a direct economic purpose. Performance indicators are sometimes called key performance indicators because they measure key parts of the organizations' measurable objectives. A key performance indicator 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 indentified 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, 2006:45). 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. Economic indicators require the relation of physical facilities provision to long term business plans. 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. They also ensure that occupancy costs are minimized.
- 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.

Although these indicators have their various measurement indices, they are inextricably linked and can be integrated into a building performance report. This helps to obtain a balanced view of the contribution of buildings as an operating resource. Figure 3.7 shows an integrated building performance reporting framework covering the five strands of performance indicators as explained.

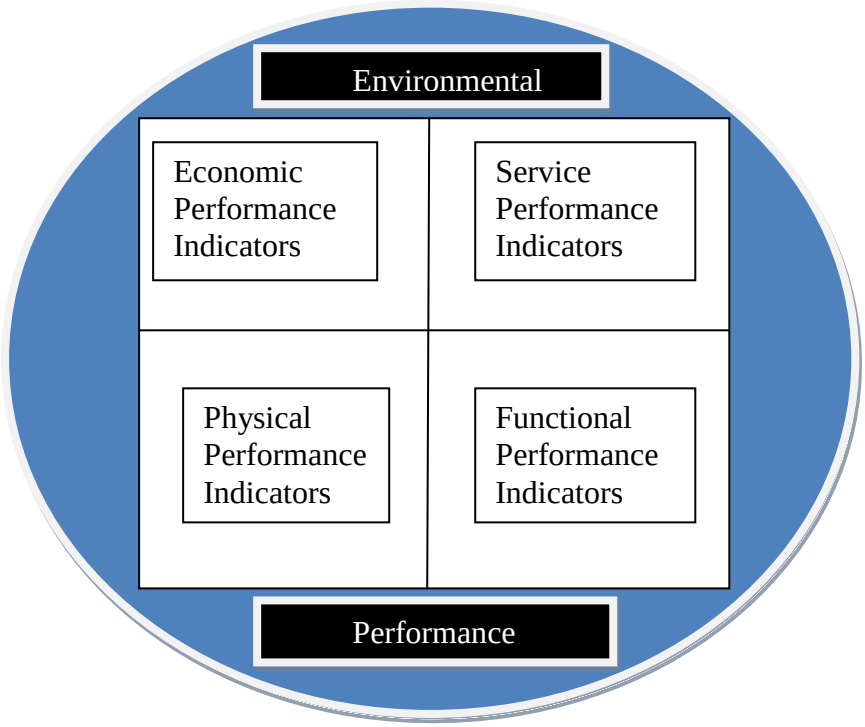

Figure 3.7 Integrated building performance reporting (adapted from Then & Tan, 2002:386).

3.4.10 Environmental and Service Performance indicators: An emerging trend

The traditional focus of performance indicators has been on economic, physical and functional measures. The modern trend reveals the emergence of environmental and service indicators as part of integrated building performance reporting shown in Figure 3.7. The implication of this trend is that qualitative measures (environmental and service performance) which focus on the effective utilization of environmental awareness and service delivery are increasingly being recognized. This shift in focus complements the traditional measures which rely purely on quantitative (financial/cost) measures/indicators (Then and Tan, 2002). To better understand the integrated view of the building performance indicators framework, a matrix which provides the basic structure for considering the five strands of performance indicators is constructed as shown in Table 3.1

The selection of performance indicators and the organizational focus depends on the context of the organization and the property/ building concerned. This is often based or influenced by the needs of the client. In public owned enterprises/organizations, building performance is essentially tied to the economic and physical indicators.

Table 3.1: The framework for building performance indicators and their focus

Performance indicators	Organizational focus	Monitoring focus
Economic	Value for money and in line with policy.	Proper allocation of resources, efficiency and effectiveness.
Functional	Fitness for purpose, flexibility and adaptability in use.	Adequate and suitable distribution, type, form and size.
Physical	Management of building life cycle, operational efficiency and risk reduction.	Inputs-outputs-outcomes.
Service	Customer/user/occupier satisfaction	User/Clients' quality perception.
Environmental	Defining and setting sustainability levels. Example, emission and temperature levels.	Satisfying the targets of sustainability at all levels.

Their primary focus is to monitor the effectiveness and efficiency of resource allocation in satisfying the demands of service delivery and operational efficiency. The private sector and agency portfolio management on the other hand are mainly concerned with the functional and service indicators of building performance. Their primary focus is related to effective utilization of physical assets and economic service delivery of core services (Then, 2005:386). The areas of environmental performance indicators are issues relating to sustainability targets and impacts on building users/occupants. In any case, environmental and sustainability targets will invariably have direct impact on the other measures/because they are inextricably linked (Obiegbu, 2005).

The problem of building performance evaluation does not lie in the preparation of a comprehensive list of performance indicators, but in having a meaningful set of indicators that are driven by a management framework capable of promoting informed decision making (Szigeti and Davis, 2005). Although performance indicators provide a mechanism for learning from the past and evaluating contemporary trends in the use of facilities, organizations, particularly public service institutions must take a more progressive commercial approach to evaluation and resource allocation than has been the case in the past (Amaratunga, 2000).

3.5 Chapter Summary

This chapter has presented the underpinning theories of building performance evaluation. The discussion of the relationships between the variables of the research clarifies the practical issues associated with facilities management, value management and building performance evaluation. The discussion shows that central to the evaluation of buildings is the concept of performance. Although the performance concept covers a wide range of disciplines and specializations, any building performance evaluation process focuses on what a building is required to do after construction and occupation.

Performance evaluation must determine the extent to which a completed and occupied building meets or satisfies the needs/expectations of the user. A building performance evaluation exercise identifies best practices in addressing maintenance and facilities management issues. The specific best practice issues include codes/standard and regulations, organization and management and building sustainability. This helps organizations in the selection of appropriate techniques for facilities solutions. The essence of building

performance evaluation is to manage and improve design practice and building performance. The discussion also identifies the indicators of the various aspects of performance. For example, functional, physical, economic, service and environmental indicators/measures. It emphasizes the integration of financial and non-financial measures in the development of an effective information system for the organization.

Facilities management encompasses a vast spectrum of perspectives about people, organization and change processes to realize the goal and value of any organization. This is based on the premise that the efficiency of an organization is linked with the environment in which it operates. Facilities management therefore takes an integrated view of the services infrastructure and uses it to deliver clients' satisfaction and best value. Facilities management is also seen as a vector of change and so must operate within a strategic framework to integrate operational decisions in an organization. There is a functional relationship between facilities management and building performance evaluation. This relationship facilitates the change process by ensuring that operational assets such as buildings perform optimally in an organization. This promotes value creation and effective resource use.

The major aim of any building project is to add value for all stakeholders. For example, functional, economic, social, aesthetic and environmental values. The concept of value management recognizes the contribution of parties involved in the building delivery process as a determinant to the creation of value and potential success of the building project. To improve the value of a constructed building, value management maintains significant links with building performance evaluation by providing a platform for resolving conflicting interests in the design process. This is facilitated through the use of data derived from previous performance evaluation activities. It must be noted that the value management exercise develops the sensitivities of the design team towards achieving value for money as it relates to buildings in use. However, the formulation of an effective building facilities strategy capable of increasing both revenue and productivity further helps in the creation of organizational value.

In the light of the foregoing, the management and performance of building facilities must be integrated into the organizational strategic plans rather than considering them as one of the projects that an organization needs to pursue. Studies have shown that the performance of operational assets have significant impact on the financial performance and overall

effectiveness of organizations. One of the common claims of facilities management relates to the fact that it is crucial to business and makes proactive contribution to business success; hence the need for its integration into the organizational strategic plan cannot be over emphasized. The underlying issue in the above discussion is that buildings must perform as functional and operational assets to enable organisations perform effectively. In this regard, the performance concept was chosen as the conceptual framework for this thesis.

Again, educational institutions are in the business of knowledge transmission and promotion of learning capacity. This is facilitated through the use of space provided by buildings as an educational tool. The physical condition and functional effectiveness of the buildings are therefore critical for educational effectiveness. The performance evaluation of educational buildings ensures that buildings meet the infrastructural challenges of educational institutions by supporting it as an enabler. It further ensures that the effectiveness of buildings is maximized not just in terms of occupancy costs but also with respect to user satisfaction. A successful educational building is determined by evaluating how the building is functioning, how the learners and teachers are utilizing the spaces and how the design has promoted the educational process.

The challenge of explosion in students' enrolment and inadequate funding from government has revealed the functional inadequacies of building facilities in the university system in Nigeria. This situation demands a proactive facilities management and building performance evaluation skill which can contribute to the strategic planning, policy decision-making and development of a facilities solution. However, the evaluation of building performance is not yet a mainstream activity in the Nigerian construction industry and so has not taken full advantage of the potential benefits of evaluation. This is a problem that needs to be fully understood. Performance evaluation could assist in development of a base level of understanding of the Nigerian situation. The performance concept is therefore applied in resolution of this problem. At this point, it is pertinent to restate the main problem and sub-problems of the research as identified in sections 1.2 to 1.4.

- Most educational institutions in Nigeria do not regard building performance evaluation as an area of legitimate interest; do not lay emphasis on the user-value of buildings and therefore procure buildings that are not adaptable, flexible and fit for purpose;

The sub-problems deriving from the main problem are as follows:

- Educational institutions do not lay emphasis on performance and user-value in the procurement of building facilities;
- Performance evaluation in educational institutions appears too trivial and does not fit into building procurement and funding stereotypes;
- A significant number of building facilities in educational institutions are not fit for purpose;
- Critical performance indicators/mandates are often absent in the design, construction and management of buildings in educational institutions;
- Building facilities in educational institutions are overstretched and inadequate for effective learning and teaching;
- There are no feedback mechanisms in the design and management of buildings in educational institutions;
- Building facilities in educational institutions are not adaptable and flexible; and
- There is poor perception and awareness of building performance evaluation among stakeholders in educational institutions.

The theoretical framework has shown why the problems identified in this research exist. It has further established the relationships between the variables of the research. The performance concept was identified as a suitable concept for evaluation and resolution of the research problem. The framework therefore serves as a vehicle that drives the research to its destination. The aim and objectives of the research constitute the destination which has been formulated for the thesis as follows:

- Aim: To develop an appropriate model for building performance evaluation in higher education institutions based on key performance indicators; for improved awareness, understanding and practice.

In this regard, the following represent the specific objectives of the study;

- Utilise the performance concept to identify the key performance indicators in educational buildings.
- Appraise the nature and type of building facilities in the targeted universities.

- Determine the suitability of the buildings and establish the extent to which they enhance both educational and operational effectiveness.
- Identify and resolve major space and environmental problems in the existing building facilities of the targeted universities.
- Develop a performance evaluation model that will incorporate best practice criteria for educational buildings.

The theoretical and conceptual framework given in this chapter has been provided from the construction management perspective. The next chapter presents the philosophy, methodology and techniques of the research.

Chapter 4: Research Methodology and Techniques

4.1 Introduction

This chapter presents the philosophical and methodological arguments that underlie the conduct of research. It also examines the methods/techniques or strategies for this study. The first section begins by bringing into focus the problems, aims and objectives of the research and then proceeds with the explanation of methodology and methods. Subsequently, discussions of the various philosophical assumptions and paradigms of research are presented. This leads to the philosophical position of the research and justifications. Discussions on the research design/ strategies and methods adopted are also presented towards the end of the chapter.

4.2 The research problem, aim and objectives

The main problem addressed by this research is as stated in section 1.3. In view of the problem statement, the sub-problem statements deriving from the main problem were formulated as shown in section 1.4.

Given the above problem and sub-problems, the aim of the research was to develop an appropriate model for building performance evaluation in higher education institutions (universities) based on key performance indicators, for improved awareness, understanding and practice. The specific objectives of the research are stated in section 1.6. From the foregoing, the methodological arguments and methods of the research must reflect the objectives and variables in the problems. The next step therefore is to explain the meaning of research methodology and how it differs from research methods.

4.3 Research methodology and methods

Generically, the search and gathering of facts/data and information for the advancement of knowledge is regarded as research. A research methodology refers to the principles and procedures of logical thought processes which are applied to a scientific investigation (Fellows and Liu, 1997; Sutrisna, 2009). Easterby-Smith, Thorpe, and Lowe (2008:31) define research as a “combination of techniques used to enquire into a specific situation”. Research methodology therefore means the overall strategy designed to achieve the aim and objectives

of the research. It includes the procedures and techniques of investigation for effective and reliable representation of the research.

Research methods on the other hand are merely tools used in gathering and analysing data for the research. Put differently, it is described as a subset of the research methodology. Thus, within a research methodology, different research methods or tools may be used to achieve the aim and objectives of the research (Sutrisna, 2009).

The selection of research methodology and methods in management and social sciences represent the researcher's assumptions about the nature of the social world and the type of knowledge to be obtained (Creswell and Clark, 2007: 5-21). These assumptions or paradigms are essential for the research because the researcher's chosen methods must reflect the context of the underlying assumptions. Accordingly, the philosophical foundations or basis and paradigms of research are presented in the coming sections.

4.4 The philosophical foundation or basis of research

To arrive at the appropriate philosophical position for this research, it is necessary to provide a descriptive analysis of the various philosophical assumptions about the nature of the social world. The analysis generally explores the reasons for studying philosophical issues in research and specifically with reference to research methodology.

There are strong reasons for a proper understanding of philosophical issues in research. Easterby-Smith *et al*. (2008) identify three reasons why the exploration of philosophy may be significant in research methodology. First, it can help the researcher to refine and specify the research methods. This includes the type of evidence gathered and its origin, the way the evidence is interpreted and how it helps to answer the research questions. Second, the knowledge of research philosophy helps the researcher to evaluate different methodologies and methods in order to avoid inappropriate use and unnecessary work. The researcher therefore identifies the limitations of a particular approach at an early stage. Third, it may help the researcher to be creative and innovative in either selection or adaptation of methods that were previously outside the researcher's experience. In addition, the nature of philosophical questioning often encourages in-depth thinking and this often generates further questions in relation to the topic under investigation (Crossan, 2003). Thus, understanding philosophical issues provides a sound basis for a methodological argument of the research.

The discussions in this section are anchored on three major dimensions or levels of research methodology, namely;

- Research philosophy and paradigms;
- Research reasoning; and
- Research data.

These levels of research are necessary because the philosophical position of the research strongly influences the reasoning of the research and both the philosophy and reasoning influence the data requirements and analysis of the research (Sutrisna, 2009).

4.5 Research philosophy and paradigms

The most basic consideration and classification of research is the philosophical level or dimension. This level relates to research assumptions based on the most general features of the world. It encompasses such aspects as the mind, matter, reality, reason, truth, nature of knowledge and proofs of knowledge (Crossan, 2003). Simply put, research philosophy refers to the philosophical assumptions and undertakings which implicitly or explicitly guide an inquiry in a study or research. A literature scan on the various philosophical views or branches reveals that the most prevalent views or positions are ontological and epistemological. Other views such as sociological and axiological assumptions (Neumann, 2000; Shakantu, 2004; Easterby-Smith *et al.*, 2008) can also be found in the research methodology literature.

4.5.1 Ontological view /assumption

Ontology explains the nature of knowledge and assumptions about reality (Pathirage, Amaratunga and Haigh, 2008).It discusses the claims and assumptions that are made about the nature of reality. The ontological view therefore refers to the researcher's position or answer to the question about the nature of the reality under investigation. This assumption about the nature of the world complements the formulation of the research philosophy and so influences the selection of the appropriate research approach and methods. Shakantu (2004:162) identifies two seemingly opposing but competing ontological views in which researchers and sociologists can base their methodology. Shakantu (2004) refers to what Babbie, (1995), Neumann, (2000) and Chia (2002) call "Parmenidean and Heraclitean" ontologies.

In the Parmenidean view or context, according to Chia (2002), "reality is composed of clear entities with identifiable or discrete properties and characteristics". In the Heraclitean world view on the other hand, reality is viewed or seen as "inclusively processual". Put differently, all things are in constant flux regardless of how they appear to the senses. These polarised ontological views only provide a shared vocabulary which can be used to describe objects and/or concepts that exist, their properties and relationships between them. Ontological concerns therefore deal with the nature and conception of reality. It studies being or existence, their basic categories and relationships to determine what entities and what types of entities exist (Sutrisna, 2009).

There are two types of ontological views based on whether the external world is having a predetermined nature and structure or not; the realist and idealist ontologies (Johnson and Duberly, 2000; Sexton, 2004). Realists start with a stance of a commonly experienced external reality with predetermined nature and structure, whereas idealists assume that different observers may have different viewpoints and that what counts for the truth varies in space and time. This view is consistent with the proposition of Gill and Johnson (2002) that research methods can be positioned by taking nomothetic (realist) and ideographic ontologies into account. Gill and Johnson (2002) define nomothetic approach as that which utilises quantified methods for data analysis while ideographic approach deals with analysis of subjective accounts generated through inside situations and involving oneself in the everyday flow of life.

Nomothetic approaches emphasize the importance of basing research upon systematic techniques as well as methods employed in the natural sciences which focus on the process of testing hypothesis. It also emphasizes the explanation of laws and deductions using quantified operational concepts. Ideographic approaches on the other hand, emphasize the analysis of subjective accounts that is generated by getting inside situations. The emphasis is upon theory rounded in empirical observations to gain explanation and understanding. In sum, while experiments and survey methods are associated with the nomothetic view; action research, case study and ethnography are associated with the ideographic view (Pathirage *et al.*, 2008).

However, whichever illustrations or examples of ontological assumptions or views are described by authors, a connecting string in all the examples is provided by the objective and

constructive continuum provided by Sutrisna (2009). In this continuum, Sutrisna (2009) explains that objectivism asserts that phenomena and their meanings have existence that is independent from the actors while constructivism asserts that phenomena and their meanings are continually being accomplished by their actors. Put differently, phenomena and their meanings are not only produced through interactions but also in a constant state of revision. These issues are further discussed in section 4.6 under research paradigms. Nevertheless, the next section deals with the epistemological research philosophy.

4.5.2 Epistemological assumption/view

Epistemology refers to the claims of what is assumed to exist and can be known. It looks at the theory of knowledge with reference to its methods, validation and possible ways of gaining knowledge in the assumed reality. Simply put, epistemology describes what the researcher knows about the reality and assumptions about how knowledge should be acquired and accepted. Epistemology therefore is concerned with how and what the researcher knows and the questions about how and what is possible to know (Shakantu, 2004:161).

In epistemological undertakings, two most commonly used examples are positivism and interpretivism. Sometimes, these may be referred to as objectivism and subjectivism. Easterby-Smith *et al.* (2008) in their review of research philosophies refer to the two ends of epistemological undertakings as positivism and constructionism. The positivists believe that the social world exists externally and that its properties should be measured through objective measures where the observer must be independent of what is being observed. Social constructivism on the other hand stems from the view that reality is not objective and exterior; it is socially constructed and given meaning by people who are conscious, purposive actors with ideas about their world and attaching meanings to what is going on around them (Robson,2002). These two fundamentally different and competing schools of thought demonstrate the complexity of the issues embodied in epistemological and ontological view points.

However, Sutrisna (2009) provides a hyper simplification of these two philosophical viewpoints by stating that positivism mainly takes objectivism as the basis of understanding the reality and that there is only one objective reality experienced by all. Similarly, interpretivism mainly takes constructivism as the basis of understanding the reality which is constructed individually and interpreted differently. It must be noted that each of the two

dimensions or viewpoints can be considered multi-dimensionally. This underlines the two dimensional continuum explained by Sutrisna (2009). The intention of the continuum is to highlight the similarities of the assumptions or links between the philosophical view points. A better understanding of these issues will be discussed in the next section on research paradigms.

4.6 Research paradigms

The science of research has its roots in philosophy. The philosophy of research can therefore be viewed as a way of describing how research can be conducted and how the real world, empirical data, models and theories relate to each other. A research methodology is driven by certain ontological and epistemological assumptions about the reality of the social world. These assumptions invariably affect how the research is carried out.

A research paradigm is the fundamental model or scheme which organises the researcher's view and reasoning (Babbie, 2005:34). Social scientists make use of a variety of paradigms to organise how they understand and inquire into social life. Thus, paradigms provide a powerful range of possibilities for structuring a research. Babbie (2005) argues that each paradigm makes certain assumptions about the nature of social reality. By their nature, paradigms are neither true nor false. They merely provide different ways of viewing and seeking explanations. Paradigms may be considered useful or not depending on the context of the study.

Saunders, Lewis and Thornhill (2007) assert that although it is useful to attach research approaches to different philosophies/paradigms, such labelling has no real practical values. However, such representations or attachments provide an understanding of how theory is related to each research philosophy. The researcher must therefore find out ways in which a particular paradigm can be useful and how it can guide the research. It is also important to note that consistency between the aim and objectives of the research, the problem statements/research questions, the methods and personal philosophy of the researcher essentially underpins and drives the research process. At this point, the following sections provide an understanding of the two extremes of research paradigms; positivism and phenomenology.

4.6.1 The positivist paradigm

The term positivism generally represents the belief in a logically ordered objective reality that can come to be known (Babbie, 2005:34). Positivism which originates from the thinking of Comte (1853); and for centuries was the dominant method of scientific enquiry derived from the study of natural sciences. Indeed, what could be described as the traditional scientific approach to research has its underpinnings in the philosophy of positivism. The positivist approach to the social sciences assumes that things can be studied as hard facts and that the relationship between these facts can be scientifically established as laws. According to the positivists, these laws have the status of truth and that social objects can be studied in much the same way as natural objects. Babbie (2005) suggests that there are three distinct generations of the positivist philosophy. These generations follow from the period which allowed the contemplation of social life to break away from religious interpretations and so established human beings as the main characters in the development and accumulation of scientific knowledge. The first generation of these philosophers include Locke, Hume, and Comte. This generation established in the 18th and 19th centuries were associated with the early traditions of positivism. They were followed by the second generation of logical positivism associated with the early 20th century philosophers. These include Carnap (1932) and Ayer (1936) collectively known as the Vienna circle (Crossan, 2003). The third generation emerged in the post war period associated with Hempel (1965).

The fundamental reasoning of positivism assumes that an objective reality exists which is independent of human behaviour and therefore not a creation of the human mind. It suggests that the senses should be used to accumulate data that are objective, discernible and measurable. Any other thing should be rejected. This implies that positivism assumes that the real world can only be studied through the utilisation of methods that prevent human contamination of its apprehension or comprehension (Nongiba, 2008:87). Logical positivists stress the importance of induction and verification and establishment of laws. This presents a major departure from the early tradition of positivism. The aim of the logical positivists is to cleanse scientific knowledge of subjective and speculative views. They do this by the use of mathematics and formal logic to analyse statements about the observed world using the process of induction as a means of establishing generalisations and laws. Put differently, the proponents of logical positivism argue that numerical methods and mathematics are considered above the human language of description and so assumed to be the only appropriate method for obtaining facts scientifically. The standard positivists (third

generation) who emerged after the Second World War focused on the need for reasoning which moves from theoretical ideas to a logical conclusion through deductive thinking.

The general features of the positivist philosophy have several implications for researchers and social scientists. These implications, according to authors (Easterby-Smith *et al.,* 2008; Pathirage *et al.*, 2008) include:

- Methodological; all research should be quantitative and that only quantitative research can form the basis for valid generalisations and laws;
- Value-freedom; the choice of how and what to study should be determined by objective criteria rather than by human beliefs and interests;
- Causality; the aim should be to identify causal explanations and fundamental laws that explain human behaviour;
- Independence; the researcher is independent of the subject under investigation; and
- Reductionism; problems are understood better if they are reduced to the simplest possible elements.

A major shortcoming of the positivist philosophy is that it does not provide the means to measure human beings and their behaviour in an in-depth manner. Human beings are not objects and are therefore subject to many influences on behaviour, feelings, perceptions and attitudes. These attributes are rejected by positivists and regarded as irrelevant; belonging to the realm of metaphysics. Although the positivist approach yields useful data for analysis, these data are limited and therefore provides a superficial view of the phenomenon under investigation. However, the positivist philosophy embraces a conception of truth in which verifiable statements agree with identifiable and ascertainable facts of reality (Crossan, 2003). Positivism therefore promotes a more objective interpretation of reality using hard data from surveys and experiments.

4.6.2 Phenomenological paradigm

A phenomenon is an observable occurrence, experience, circumstance or fact that is perceptible to the senses. Phenomenology is therefore concerned with methods that examine people and their social behaviour. Phenomenology has its roots in the social sciences and so sees the social world as a world of meanings. Thus, the social world is not made up of entities which are external to the subjective experience of its members. The phenomenological or

interpretivist perspective offers researchers and social scientists a radical alternative to the positivist methodology. From the phenomenological viewpoint, there is a fundamental difference between the subject matter of the natural sciences and that of the social sciences.

Natural science deals with matter which lacks consciousness; its behaviour can therefore be explained as a reaction to the external stimuli. But this cannot be said of human beings. Human beings see, interpret and experience the world in terms of meanings and actively construct their individual social reality. Meanings do not have independent existence; they are rather constructed and reconstructed by actors in the course of social interaction. This clearly explains why the positivist and phenomenological perspectives employ different research methods. They proceed from diametrically opposite assumptions about the nature of social reality (SOCYBERTY, 2008).

Phenomenology holds that assumed notions and perceptions are often out of contact with the entities they purport to see, know or interpret; it calls for a return to the foundations of meaning and experience. Shakantu (2004) notes that in phenomenological research, data are collected in the form of words and observations and analysis are based on the interpretation of these data rather than numbers and statistical manipulations. Authors (Saunders *et al.*, 2000; Crossan, 2003; Veal, 2006; Easterby-Smith *et al.*, 2008) have highlighted the main features or elements of the positivist and phenomenological paradigms of research. A summary of these features and research implications are provided in Table 4.1.

Table 4.1 Summary of implications and basic features of Positivism and Phenomenology

Key areas	Positivism	Phenomenology
Basic viewpoints and beliefs	The world is external and objective; the observer is independent; and science is value-free.	The world is socially constructed and subjective; the researcher is part of what is observed; and science is driven by human interests and motives.
Method of research	Focus on facts; look for causality and fundamental laws; reduces phenomenon to the simplest elements; and formulate hypotheses and test them.	Focus on meanings; try to understand what is happening; look at the totality of each situation; and develop ideas through induction from data.
Research design	Structural, formal and specific detailed plans	Evolving and flexible
Involvement of the researcher	The researcher remains distanced from the material being researched; short term contact.	The researcher gets involved with the phenomenon being researched; long term contact; emphasis on trust and empathy.
Preferred strategy	Operationalisation of concepts so that they can be measured.	Use of multiple methods to establish different views of phenomena.
Sampling	Large samples and numbers selected randomly	Small samples investigated in-depth or over time/small numbers of cases chosen for specific reasons.
Data collection methods	Experiments, surveys, structured interviews and observation.	Observations, documentation, open-ended and semi-structured interviews.
Research instruments	Questionnaires, scales, test scores and experimentation.	Researcher
Strengths	Provides wide coverage of the range of situations	Ability to look at change processes over time

4.6.3 Combined approaches

The rationale/need for a sound understanding of philosophical issues in research has been established in section 4.4. In this section, the combined approach refers to a combination of the whole or parts of different research philosophies either originating from the same or different paradigms in a particular research situation (Nongiba, 2008:97; Pathirage *et al.*, 2008).

Many researchers discuss the various philosophical stances only from the perspective of their research. Nevertheless, philosophical stances actually portray a bigger picture because the researcher's perception of reality influences to a great extent the conduct of the research. Researchers can approach theory building and testing from different directions. While some researchers predominantly use experiments and surveys to test theories, others use action research and ethnography for theory building (Pathirage *et al.*, 2008). This approach places research at polar opposites as it infers that the methods are mutually exclusive. This polarization is obvious in the preceding sections of this chapter. Evidently, a synthesis of the discussions on philosophical assumptions and paradigms shows that nomothetic; realist; Parmenidean and objective view points or assumptions are consistent with the positivist

philosophy (positivism).On the other hand, ideographic; idealist; Heraclitean; interpretivist/subjective or constructivist view points are consistent with phenomenology. Within the positivist ideology, research moves from theory to data and within the phenomenological ideology, research moves from data to theory (Pathirage *et al.*, 2008).

However, the richness of real world situations implies that a particular paradigm or assumption is unlikely to present a complete picture. Simply put, different philosophical assumptions or viewpoints provide different perspectives of the real world. This can be likened to viewing the world through a telescope or an X-ray machine. Each of these can only reveal certain features while blinded to others.

From the foregoing, the following arguments support the possibility of adopting more than one view point in a research. Providing insight into the nature of philosophical stances/paradigms, Babbie (2005:34) argues that paradigms represent a variety of views; each of which offers insights the others lack while ignoring aspects of social life that the others reveal. In their view, Easterby-Smith *et al*. (2008:57) state that the dichotomy between the positivist and phenomenological world views has led to sharp differences of opinion between researchers about the desirability of methods. Easterby-Smith *et al.* (2008) maintain that the practice of research involves a lot of compromises between pure positions. This understanding suggests that seeing positivism and phenomenology as related concepts is useful.

Again, the understanding that empirical and theoretical research is a dialectical relationship helps in seeing research approaches as a set of tools or directions which the researcher may draw on as and when appropriate. The growing disclosure on philosophical and methodological pluralism in modern research further challenges the polarised views on philosophies and approaches (Pathirage, 2008).

Construction management as a discipline combines highly complex, technical and social systems and is therefore at the centre of natural and social sciences (Shakantu, 2004). This implies that some aspects of positivism (natural science) and phenomenology (social science) can both be relevant in construction management researches and can be therefore used in a complementary manner. Having established this fact, the philosophical position of this research and the justification for the stance are discussed in the next section.

4.6.4 Research position and justification

The relationship between truth and theory is at the heart of science; determining when and if a theory should be accepted as reality (Pathirage *et al.*, 2008). This philosophical realism and anti-realism debate explores the basis of a commonly accepted scientific truth. All the philosophical positions or views have their merits and demerits but adoption of a particular view point depends on the situation or context of the research. Given the problems highlighted in sections 1.3 and 1.4, this research taps into the rich varieties of the theoretical perspectives that can be brought to bear on the study. This multi paradigmatic position follows from the research context (building performance evaluation in the university system) and the complexity of information required in shedding light on the performance and management of educational buildings. This particular field of research falls within construction management and since construction management is at the centre of natural and social sciences, the combined approach is considered suitable for the research. Each view point brings special strengths; and each compensates for the weaknesses of the other.

However, the justification for the adoption of the multi-method position is presented as follows:

- Epistemologically, the research is objectivist and paradigmically positivist. It is positivist because the problem being investigated is an objective social reality requiring observation and survey of discrete and identifiable objects and phenomena.
- Ontologically, the research is Parmenidean and realist because the objective of developing a building performance evaluation model (with identifiable variables) provides some sort of evidence to support generalizations about the performance of educational buildings.

It has earlier been stated that the philosophical position of the researcher strongly influences the research reasoning and invariably the research data. This implies that the multi-method position of this research must be reflected at the reasoning and data levels of the research. The coming sections provide a discussion on research reasoning, research data, methods adopted and research design for this thesis.

4.7 Research reasoning

The next level or dimension of research is the reasoning of research. As stated earlier, this is strongly influenced by the philosophical stance of the researcher. Reasoning of the research refers to the logic of the research, the role of existing body of knowledge gathered in the literature study, the ways the researchers collect data and subsequent data analysis (Sutrisna, 2009). The research reasoning connects the researcher to the specific approaches and methods for collecting and analyzing data. However, the research reasoning or approach can be empirical, non-empirical or a combination of the two. For the empirical research, whatever the purpose, empirical evidence is required and this means that the research must be based on data obtained from observation or experience. Easterby-Smith *et al*. (2008) show that the study of real organizations or social setting may be based on the positivist or phenomenological paradigms.

There are three main dimensions of empirical research, namely;

- Deductive and inductive research;
- Quantitative and qualitative research; and
- Subjective and objective research.

Although these dimensions do not necessarily represent a simple choice, they reflect the extent to which the elements of the research approach apply. Non-empirical research is based on pre-existing body of knowledge in a particular field. Some researchers depend entirely on this method and are generally known for searching and reviewing literature on a certain subject where the subject may be one of an historical nature. In this case, the research does not lend itself to any other form of investigation (Saunders *et al.*, 2000:45-46). The combined approach takes into account both empirical and non-empirical approaches to inform the structuring and execution of research activities. This thesis is contextually empirical and non-empirical and based on this understanding, the reasoning of the research is based on the combination of both approaches. At this point, it is necessary to discuss deductive and inductive; quantitative and qualitative; and subjective and objective approaches to empirical research.

4.7.1 Deductive research

A deductive research is simply a study in which theory is tested by empirical observation. It is sometimes described as moving from the general to the particular. Sutrisna (2009) contends that a deductive research traditionally begins by analyzing the literature. That is, studying existing works in the field and providing the context of the research. It continues by identifying and stating a single selected problem leading to the isolation of the major research sub-problems/questions in which the existing knowledge may be inadequate. For example, identified gaps between existing theories/evidence or contradictions to be explored/new contexts for applying previous findings. This is then followed by the formulation of hypotheses which may be in the form of a conceptual model, proposed to address the identified problem and sub-problems. It may further consist of steps to test the hypotheses. Sutrisna (2009) maintains that subsequent data collection using the proposed methods is followed by analysis resulting in findings closely linked to the existing body of knowledge earlier found.

Clearly, a deductive research tends to proceed from theory to data. As Gill and Johnson (2002) assert, a deductive research entails the development of a theoretical and conceptual framework prior to its testing through empirical observation. In this approach, the researcher may have deduced a new theory by analyzing and then synthesizing ideas and concepts already present in the literature. The emphasis here is on the deduction of ideas or facts from the new theory in the hope that it provides a better or more coherent framework than the theories that preceded it. Highlighting a detailed description of the deductive process, Robson (2002) introduces five sequential stages of deductive research as;

- Deducing a hypothesis from theory;
- Expressing the hypothesis in general terms;
- Testing the operational hypothesis;
- Examining the specific outcome of the enquiry; and
- If necessary, modifying the theory.

According to Collis and Hussey (2003), deduction is the dominant research approach in the natural sciences where laws present the basis of explanation, allow the anticipation of phenomena, predict their occurrence and permit them to be controlled. A deductive research can be considered in line with objectivism and positivism due to its reliance on current body

of knowledge in composing hypothesis. Since there is only one objective truth, the researcher's investigation can be based on the existing body of knowledge which have been significantly proved and therefore must represent the objective truth (Sutrisna, 2009).

4.7.2 Inductive research

An inductive research is a study in which theory is developed from the observation of empirical reality. In this regard, general inferences are induced from a particular instance which is the reverse of the deductive research. It involves moving from individual observation to statements of general patterns or laws (Collis and Hussey, 2003). Inductive research tends to proceed from data to theory (method, data, findings, theory). Within the inductive approach, learning is done by reflecting upon particular past experiences through the formulation of abstract concepts and theories. Hence, the outcome of induction is theory (Gill and Johnson, 2002).

Providing insight into inductive research, Sutrisna (2009) states that it intends to learn about the phenomena under investigation by applying a less structured methodology to obtain richer and deeper information. In an attempt to provide answers to the phenomena in question, inductive researchers try to keep their minds open for any possible results while proposing further steps for data collection. In certain methodologies for example, the grounded theory, (a methodology that allows the researcher to develop a theoretical account of the general features of a topic while simultaneously grounding the account in empirical observations or evidence) a literature review is not recommended in the early stages to minimize the possibility of the researcher being influenced by presuppositions. Explanations and theories are then developed by from the observations of the empirical world (that is, based on the data collected).

Induction is the dominant research in the social sciences. Although the deductive/inductive research debate has a long history, Gill and Johnson (2002) claim that the modern justification for taking an inductive approach in the social sciences tends to revolve around two related arguments;

- The explanation of social phenomena grounded in observation and experience; and,
- Criticism of some of the philosophical assumptions embraced by positivism.

For most of the researchers working within the inductive tradition, explanations of social phenomena are relatively worthless unless they are grounded in observations and experience. The main difference between deductive and inductive research lies on the use of current body of knowledge and the role of data collection. Deductive researchers formulate hypotheses based on the current body of knowledge and then conduct a data collection and analysis to test the hypotheses. Inductive researchers on the other hand conduct data collection and analysis to come up with findings while using the current body of knowledge to inform their data analysis as deemed appropriate (Sutrisna, 2009). Inductive researchers argue that theory, inductively developed out of a systematic empirical research is more likely to fit the data and thus is useful, plausible, and accessible (Partington, 2000).

Another fundamental issue in the deductive/inductive debate is the subject matter of the social sciences and that of the natural sciences as mentioned earlier. Fundamentally, there is an ontological discontinuity between human beings and objects or things. The distinction here is that human beings experience the world, whereas things do not (Pathirage *et al.*, 2008). This distinction underlines the philosophical stances of research. Inductive research therefore can be considered in line with phenomenology and subjectivism or interpretivism. The major differences between inductive and deductive research are provided in Table 4.2

Table 4.2 Differences between deductive and inductive research.

Deduction	**Induction**
Moves from theory to data	Moves from data to theory
Common with natural sciences	Common with social sciences
Approach is highly structured	Approach is flexible and amenable to changes (less structured).
Explain causal relationships between variables.	Explanation is based on understanding of meanings attached to events by human beings (focus on meanings).
Select samples of sufficient size to generalize conclusions.	Pay less attention to the need to generalize.
Reliability is high	Reliability is low with high validity
Formulate hypotheses and test them	Develop ideas through induction from data.

Source: Adapted from Saunders *et al.* (2007).

Moreover, a further synthesis of discussions on research paradigms and research reasoning shows that deductive/objective research can be associated with positivism while inductive/subjective research can be associated with phenomenology or social constructionism. The research described in this thesis is both deductive and inductive. The

arguments advanced for the multi-method position of this research in section 4.6.4 underscores this approach. Specifically, the rationale behind the deductive and inductive reasoning of this research is explained as follows:

- Deductively; the research moves from theory to data. This is evident in the review of pre-existing/current body of knowledge in building performance evaluation (chapters two and three) and therefore used as a source of reference for research in this field. The review further identifies the key academic theories and concepts in building performance evaluation. In addition, hypotheses are formulated to facilitate testing and explanation of causal relationships between the variables identified in the research problems (see sections 1.3 and 1.4).
- From the perspective of induction, the exploratory approach is used to improve understanding of the case-study organisations (universities) using focus group discussion and interview schedules. This helps the researcher to obtain information on the stakeholders'(staff, students, designers and facilities managers) opinion and perceptions about performance evaluation and building facilities management (further explanations on this will be provided in the coming sections).

4.7.3 Subjective and objective research

This refers to the extent to which the researcher's prejudices/presuppositions influence the outcome of the research. This can be found in the research paradigm adopted by the researcher. If the researcher is involved in or has an influence on the research outcome; then, the researcher is subjective. If on the other hand, the researcher is distanced from or independent in the execution of the field work; then, the researcher is said to be objective. Empirical research can be objective or subjective depending on the level of involvement of the researcher.

The traditional assumption that in science, the researcher must maintain complete independence if there is to be any validity in the results produced (Easterby-Smith *et al.*, 2008) supports the positivist research paradigm which is mainly objective. However, phenomenology by its very nature is subjective. Its use therefore requires participation in both real world circumstances and participation (sometimes directly) of the researcher. It must be accepted, however, that such a subjective approach used in a research requires the

recognition of any influence or limitation the subjectivity may have on the conduct or findings of the research.

Supporting the combination of deductive and inductive reasoning in a research, Saunders *et al.* (2007:119) argue, 'not only is it perfectly possible to combine deduction and induction within the same piece of research, but it is often advantageous to do so'. Anecdotal evidence shows that most researchers readily agree that research is a function of both deductive and inductive analysis, even though they know that they must present their research in an inductive or deductive style. The connecting thread or links between these approaches will become clearer with the next discussion on research data.

4.8 Research methods and data

The discussion in this section is anchored on the collection of data based on characteristics generally grouped as quantitative or qualitative. In order words, data is discussed here in terms of methods or approaches to data collection. As a convention, quantitative data requires a quantitative approach or method and qualitative data requires a qualitative approach or method in the collection and subsequent analysis of data (Sutrisna, 2009). In positioning the research methods or approaches, the philosophical assumptions and research paradigms must be taken into account. Therefore, the following sections provide an overview and discussions of these methods or approaches to research.

4.8.1 Quantitative method/approach to research

Quantitative research is a research that utilizes quantitative methods for data collection and analysis. This research approach emphasizes the importance of basing research upon systematic techniques and methods employed in the natural sciences. The approach focuses on the process of testing hypotheses (Pathirage *et al.*, 2008). The quantitative research method seeks to gather factual data and study relationships between facts. The analysis of quantitative data yields quantitative results and conclusions are drawn from the evaluation of these results based on theory and literature.

Quantitative researchers seek causal determination, prediction and general isolation of findings. Thus, the methods employed are also known as scientific methods. Sutrisna (2009) argues that the quantitative approach positions the researcher as a neutral observer of the phenomena in question in order to maintain distance or objectivity from the research subject.

This implies that the quantitative approach is based on the positivist ideal which advocates that mathematics is the perfect tool to understand the worldly creation. Supporting this view, Nahiduzzaman (2006) maintains that researchers who use logical positivism employ experimental methods and quantitative measures to test hypothetical generalization. Nahiduzzaman (2006) further claims that quantitative researchers emphasize the measurement and analysis of causal relationships between variables. Quantitative methods are assumed to be repeatable and capable of isolation from reality without compromising the cause and effects being studied. Illustrating the meaning of quantitative research in the explanation of social problems, Nahiduzzaman (2006) notes that charts and graphs illustrate the results of quantitative research and commentators employ words such as 'variables, populations and result' as part of their daily vocabulary.

Quantitative research allows the researcher to be familiarized with the problem or concept to be studied. Since the emphasis is on facts and causes of behaviour, the information derived is in the form of numbers that can be quantified and summarised. Furthermore, as the mathematical process is the norm for analyzing the numerical data, the final result is expressed in statistical terminologies. The quantitative research as supported by the positivist or scientific paradigm leads us to regard the world as made up of observable and measurable facts.

A quantitative researcher attempts to fragment and delimit phenomena into measurable or common categories that can be applied to all subjects or even a wider range of similar situations. In this regard, the researcher's method involves the use of standardized measures in order to accommodate the varying perspectives and experiences of people, in a limited number of predetermined response categories to which numbers are assigned (Patton, 2002:2-48). To illustrate this approach, a quantitative researcher may prepare a list of behaviours to be checked or rated by an observer using a predetermined schedule or number scale as an instrument. This quantitative researcher needs to construct an instrument to be administered in a standardized manner according to the predetermined procedures. In doing this, the researcher must ensure that the instrument measures what it is supposed to measure. The significance of this test is to ensure reliability or repeatability of the results.

4.8.2 Qualitative method/approach to research

The qualitative method of research is that which uses a naturalist (natural environment) approach to understand phenomena in their context-specific settings. For example, a real world setting where the researcher does not attempt to manipulate the phenomenon of interest (Patton, 2002:39). Qualitative methods have been considered capable of studying complex situations, particularly research involving human beings and therefore yield rich findings (Sutrisna, 2009). Qualitative research focuses on the qualities of the phenomena under investigation rather than numeric measurement. In this method, the researchers believe that the real world phenomena need to be assessed from within the context of that reality. The qualitative approach affords the means of providing distinct data and evaluation of theoretical problems and approaches (Mckie, 2002). In broad terms, any kind of research that produces findings which are not obtained from statistical procedures or other quantitative means can be regarded as a qualitative research. This implies that the findings of a qualitative research are obtained from real world settings where the phenomena of interest unfold naturally.

The qualitative approach is based on the assumption that there is no singular objective reality. Thus, the observed reality is related to the researcher's interaction with the phenomenon (Creswell, 2002; Sutrisna, 2009). Accordingly, the qualitative research naturally emerges from the phenomenological and interpretivist/ constructivist paradigm. Supporting this view, Nahiduzzaman (2006) argues that qualitative and quantitative analysis result in different types of knowledge. While the qualitative approach relies on the underlying phenomenological philosophy; enjoying detailed interview and observation, the quantitative approach relies on the positivist paradigm; enjoying the rewards of both numbers and words. This suggests that such methods as interviews and observations are dominant in the naturalist (interpretivist) paradigm and supplementary in the positivist paradigm. Graziano and Raulin (2007: 129) argue that qualitative research can be used as a method or as a precursor to the quantitative method in less explored areas. It can also be used to provide descriptive information for the generation of theory.

Two major objectives of a qualitative research are to describe and analyze the processes through which social realities are constructed; and the social relationships through which people are connected to one another. The approaches to qualitative research include;

- Grounded theory which uses the principles of inductive approach to develop theory from data collected using qualitative data gathering techniques such as unstructured interviews and participant observation;
- Case study which allows an in-depth investigation of social phenomena using a combination of data gathering techniques. The case approach allows for an in-depth investigation of a particular issue within the context of its relationship with the real world;
- Phenomenology which focuses on generating meanings and gaining insights into phenomena by concentrating studies on human experience and the essence of human experience;
- Ethnographical research method which is common to the field of sociology and anthropology. It employs a multi-method of data collection including participant observation, interviews, conversations, photographs, life histories, documentary analysis and films;
- Hermeneutics relating to the meaning given to texts, cultures and past civilizations. Its underlying assumption is the interpretivist ideology;
- Historical research method which is concerned with the process of learning the past through the collection and analysis of relevant information such as records, letters, reminiscences, buildings and artefacts, autobiography and diaries.

Practically, these qualitative approaches may adopt either a field research or a non-reactive research. Brewer and Hunter (2006:1-2) define a field work as observing and studying people and events first hand in natural social settings, whereas a non-reactive research employs un-obstructive observational techniques, artefacts, archival records, official statistics or by-products of past social life. A summary of the major differences between qualitative and quantitative research approaches is provided in Table 4.3.

The assumptions underlying the qualitative research deny the investigation of the world out there; rather, the meanings, interpretations and logic that the social actors attach to the world matters.

Table 4.3 Distinction between quantitative and qualitative research methods.

Quantitative method	Qualitative method
Developed in the natural sciences to study natural phenomena.	Developed in the social sciences to study social and cultural phenomena
Positions the researcher as neutral observer of phenomena.	No singular objective reality; observed reality is related to researcher's interaction with phenomenon.
Method is based on positivist ideal.	Method is based on phenomenological viewpoint; focuses on meanings and perceptions.
Quantitative researches are deductive by nature.	Qualitative researches are inductive by nature.
Quantitative methods include surveys, laboratory experiments and mathematical models.	Methods include action research, case-studies and ethnography.
Findings are focused on numeric measurements/quantitative data.	Findings are focused on illuminating the qualities of phenomena.
Approaches are repeatable, capable of isolation and therefore generalisable.	Yield rich but complex data and so not easily isolated or generalized.
Credibility depends on construction of data collection instrument: content related and criteria related.	The researcher is the instrument and so validity depends on the rigour, thoroughness and appropriateness of method.

Adapted from Nahiduzzaman (2006)

4.8.3 Methods adopted for the research (mixed or multi-method)

The method adopted for this thesis is both quantitative and qualitative. This is also referred to as mixed method/multi-methodology. The assumptions underlying the quantitative and qualitative approaches to research represent the two extremes of the data continuum. While the quantitative approach is linked with the deductive-objective-generalising domain, the qualitative approach is associated with inductive-subjective-contextual domain (Morgan, 2007; Sutrisna, 2009). Nevertheless, research problems do not usually tie neatly with the assumptions of these methods/approaches. Rather, research problems are better understood by employing both methods and using them in a complementary manner (Pathirage *et al.*, 2008). It is common to adopt both the quantitative and qualitative methods in research because such approach benefits from the advantages associated with each of the methods while at the same time avoiding the weaknesses of each. Put differently, the weaknesses of the one method are compensated for by the strengths of the other. This is illustrated in Table 4.4.

Supporting the adoption of mixed methods/multi-methodology in a research, Brewer and Hunter (2006:4) argue that the fundamental objective of a combined or mixed method is to "attack a research problem with an arsenal of methods that have no overlapping weaknesses in addition to their complementary strengths".

Table 4.4 Strengths and weaknesses of quantitative and qualitative methods of research.

Quantitative method (Strengths)	Qualitative method (Strengths)
Representativeness	Holistic and detailed
Possibility of impartial disproof	Reactivity
Control (rigour)	Naturalism
Weaknesses	**Weaknesses**
Limited scope	Non-representative
Artificiality	Lack of control of bias

Adapted from Miller and Brewster (2003:327).

Research employing this approach benefits from a world view of social reality which encompasses the assumptions underlying both methods. The mixed method provides the researcher with the freedom to use all methods that are suitable to a research problem; both quantitative and qualitative techniques may be used in combination with inductive and deductive reasoning. The method therefore allows the researcher to be flexible and practical in the use of procedures for data collection and analysis. The multi-method approach is often labelled triangulation which refers to the combination of two or more theories, data sources, methods or investigators in a study of a particular phenomenon to converge at a single construct (Shakantu, 2004:173).

Solutions to research problems based on the multi-method approach are likely to have a firmer empirical base and greater theoretical scope as such methods may be grounded in different paradigms (Brewer and Hunter, 2006:15). Again, the position of this research essentially underscores the adoption of the multi-method approaches to the study. The assumptions underlying the multi-method are based on a blend of both quantitative and qualitative assumptions to provide a view of the nature of the social world and the nature of knowledge. This multiple world view presents the researcher with a better understanding of the issues raised in relation to building performance evaluation within the study context.

From the foregoing, the elements of both quantitative and qualitative methods applying to this research are presented as follows:

- Quantitatively, descriptive information on the impact of building performance on students' academic achievements and staff productivity is required. Staff and students

are expected to identify and rank the key performance indicators in educational buildings. Blaikie (2003:47) claims that "quantitative methods are used when the data have been collected in, or are soon converted into numbers for analysis, while qualitative methods are used when data are in words and remain in words throughout the analysis". The survey approach (quantitative instrument) is employed to obtain this information. Data generated from the numeric measurement of classroom and office spaces are analysed and interpreted using descriptive and inferential statistics. Information is also required on broader issues such as the incidence of compliance with standard guides, regulations, codes and policies on physical facilities (buildings) in the targeted universities. This provides evidence to support generalisation about building facilities management practices.

- Qualitatively, the research tends to produce rich and subjective data due to the level of involvement of the researcher in the data gathering process. For example, data is required on opinions, explanations and perceptions of different aspects of building performance within the case organisations. These require the use of qualitative tools such as interviews and focus group discussions. The case-study approach therefore fits well with this research due to the qualitative nature of these data (the justification for the case-study adopted for this research is discussed in sections 4.9.2 and 4.9.3).

Although the qualitative aspects would encapsulate the experiences of staff and students in the target institutions, it would not be useful when the need to generalise the results from the institutions arises. Hence, the need for mixed methodology which includes both qualitative and quantitative methods of data collection. The argument here is that the use of mixed-method produces more diverse data than single methods. However, the mixed method requires a high level of competence and skill in data collection and analysis (Bryman, 2007).

The mixed method gives the researcher the opportunity to compare results and findings from different data sets; this implies that they must be employed with caution as the prior use of one method may affect the next method's observations. For example, in a survey method followed by a focus group interview; it may be observed that the respondents' behaviour as focus group participants can be affected by their earlier experience as survey participants. Respondents can be insulated from such effects by misrepresenting the purpose of the study, disguising the investigator/researcher and concealing data collection from subjects where possible (Nongiba, 2008). However, this perspective may not be acceptable due to the ethical

orientation of examiners and researchers. In addition, the possibility of authors placing emphasis on findings related to a preferred method may arise in a multi-method approach. For example, the nature of data may suggest a more compelling result of the qualitative component than the quantitative component and vice versa (Bryman, 2007).

Researchers employing this technique or approach must therefore demonstrate creativity and innovation to the strategy. Adequate care has been taken in addressing these issues as well as the rigour of each method employed in the research.

4.9 Research design

A research design refers to the guideline that links the various elements of the research methodology. Paradigms are related to the research design and the design related to the methods of data collection (Denzin and Lincoln, 2000:22). Research design includes the practical procedures adopted for accessing the subjects of the study. It is a broad plan of how the researcher intends to go about answering the research questions (Saunders *et al.*, 2000:98). This makes it clearer for the researcher to obtain the type of information required for the study; and to draw inferences concerning the causal relations among variables of the study. According to Sekaran (2003), the various issues involved in research design include the purpose of study, the type of investigation, the sampling method to be used, data collection method and the process of data analysis.

The research in this thesis is concerned with the performance evaluation of buildings in educational institutions (universities) in the South Eastern part of Nigeria. The literature review revealed the key issues and generally accepted facts of the problem under investigation. The review enabled the researcher to identify and understand the theories or models and concepts used by previous researchers in building performance evaluation. Essentially, the review further helped the researcher to identify clearly the unresolved problems of the study which form the main focus of this thesis. However, there is need to establish the adoption of a conceptual model for this study in the next section.

4.9.1 Conceptual model for the performance evaluation of buildings

The theoretical models and concepts used in building performance evaluation have been discussed in section 2.10 and 3.4 of this thesis. These models include the process model, the building condition and student assessment model, PEB organising framework for evaluating

quality in educational spaces, the school building assessment model and the balanced scorecard (BSC) model.

The application and relevance of a particular model depends on the type of evaluation to be conducted. The process model only identifies and considers three levels of performance namely; health and safety, functional efficiency and social/psychological or aesthetic performance levels. These levels are selected based on finance, time and manpower. These parameters are not present in this study. First, the study has not been commissioned by anybody or organisation and so all the financial requirements are not covered. Second, the time frame for this research is insufficient for a process model. Although, some aspects of the model (particularly, the research instruments) are relevant to this study, it is most appropriate in 'expert-based' performance evaluation study.

This study is essentially 'user-based' and therefore will not fit into the process model. Similarly, the building condition and students' achievement model is not appropriate for this study because it is useful for the assessment of building conditions in maintenance studies or evaluations. Again, the model is not holistic because the range of variables (temperature, ventilation, aesthetics, space, and colour) identified by the model and their impact on students' academic achievement are narrow. It did not consider such factors as budget priorities, management decisions and trained personnel which also affect building condition and students' achievement.

The school building assessment model is only an assessment checklist or tool to discover and reflect upon the physical features of an educational building. It does not therefore fit properly into the context of this research. It can only be useful as an evaluation or assessment tool especially in data collection. The research described in this thesis is essentially multi-method; and so draws from the rich benefits of different approaches. The benefit of this model as a data collection tool is therefore useful to the research.

Given the organisational context of this research and the nature of the problem which centres on the need to explore the application of building performance evaluation in educational institutions (universities), the PEB organising framework for evaluating quality in educational spaces (OECD, 2006) and the balanced scorecard (BSC) model are most appropriate for this study. The PEB organising framework is the product of experts participating in the 2006

meeting of the organization for economic co-operation and development on evaluating quality in educational facilities (OECD, 2006). The framework consists of two dimensions; the first dimension addresses how quality is defined within the context of policy issues and the second dimension presents important characteristics in the process of evaluating aspects of quality in educational facilities.

The relationship between these two variables has been illustrated in Table 2.5. As stated in that table, this framework identifies three specific issues which reflect the contribution of quality educational facilities to key areas of educational policy, namely; increased access and equity to education, improved educational effectiveness and optimizing building performance. This framework is facilities intensive and adequately supports the aims and objectives of this research.

The balanced scorecard also forms part of the analysis of the research problem. The BSC makes a compelling case for the inclusion of non-financial measures in the overall performance evaluation system of an organisation. The variables identified in section 2.5 and highlighted in section 3.4.1 as the performance aspects to be evaluated in this study are both financial and non-financial. They therefore involve the collection of qualitative and quantitative data. The balanced scorecard adequately integrates these measures. It therefore tells the story of an organisation's strategy by a cause-and-effect model which eventually links all the measures to the stakeholders' value. The model combines the various perspectives shown in Figure 2.3 to provide a comprehensive view of the organisation and the most critical areas of business that top management should focus. In this process, the vision is made explicit; shared and communicated in terms of goals and incentives. These are used to focus work, allocate resources and set targets.

4.9.2 Research methods/approaches.

To provide acceptable answers to the problem and sub-problems of the research, various research designs are available. According to authors (Neumann, 2000; Yin, 2003; Babbie, 2005:306-325; Leedy and Ormrod, 2010), these research design alternatives include:

- Experimental; which involves the creation of an experiment often common in pure scientific research;

- Surveys; which are often used where large volumes of data are involved with quantitative methods of analysis;
- Grounded theory; which is an inductive approach to the study of social life. It attempts to generate theory from the constant comparison of unfolding observations. In this regard, theory is generated by observations rather than being decided before the study;
- Ethnography; which is a phenomenological methodology stemming from anthropology and uses observed patterns of human activity;
- Action research; which is where the research takes more of the form of field experiment;
- Modelling; where particular models are developed as the focus of the research activity;
- Operational research; which looks at activities and seeks to understand their relationships, often with particular emphasis on operational efficiency; and
- Case-studies; which seek to understand social phenomena within a particular setting. It focuses attention on one or a few instances of some social phenomena.

According to Yin (2003:1), the choice of a design or strategy in social science research depends on three conditions, namely;

- The type of research question;
- The control an investigator has over the actual behavioural events; and
- The focus on contemporary as opposed to historical events.

In this research, given the exploratory nature of the study; the research problem stated in section 1.3 and the fact that the researcher has little control over the way in which the stakeholders (students, staff, clients and designers) would feel about building performance or respond to the performance indicators, the case-study alternative was considered appropriate for the research.

4.9.3 The case-study alterative.

Case-studies are concerned with providing credible representations of reality and so gives the reader a sense of 'being there' (Walker, 2002). The choice of case-study alternative for this research is reinforced by Yin's (2003) assertion that case-studies are the preferred strategy

when ‘how’ and ‘why’ questions are being posed; when the investigator has little control over events and when the focus is on a contemporary phenomenon within some real-life context.

Yin (2003) goes further to say that the essence of a case-study and the central tendency among all types of case-study is that it tries to illuminate a decision or set of decisions; “why they were taken, how they were implemented and with what result”. Yin (2003:14) therefore posits that Case-studies are tailor made for exploring new processes or behaviours; they may also have sub cases embedded within them and this may have the added advantage of allowing the researcher a deeper understanding of the processes and outcomes of cases. The nature of this research requires deep understanding and an intensive study that would enable the researcher to get acquainted with the study setting and win the confidence of the key stakeholders in the organisations.

There is little consensus among authors about what constitutes a case-study. Thus, the term is used broadly. Gillham (2000:1) defines it as a unit of human activity embedded in the real world; which can only be studied or understood in context; which exists in the here and now; and which emerges in/with its context so that precise boundaries are difficult to draw. A case study investigates these issues and answers specific research questions. Babbie (2005:306) defines it as an in-depth examination of a single instance of some social phenomenon such as village, family or group. Its essential feature is that it limits attention to a particular instance of something. According to Jensen and Rodgers (2001:237-239) case-studies are classified as follows:

- Snapshot case-study; which refers to a detailed and objective study of one research entity at one point in time;
- Longitudinal case-study; which involves a quantitative and /or qualitative study of one research entity at multiple time points;
- Pre-post case-study; which is a study of one research entity at two time points separated by a critical event. A critical event is one that on the basis of a theory under study would be expected to impact the case observations significantly;
- Patchwork case-study; which is a set of multiple case-studies of the same research entity using snapshot, longitudinal and/or pre-post designs. The multi-design

approach is intended to provide a holistic view of the dynamics of the research subject;

- Comparative case-study which is a set of multiple research entities for the purpose of cross unit comparison. Both qualitative and quantitative comparisons are generally made.

The research described in this thesis was undertaken as a set of multiple case-studies of the same research using a snapshot approach. Multiple case studies follow replication where each case constitutes a whole study (Amaratunga, 2001). In this way, facts are gathered from various sources and conclusions drawn on them. The rationale behind the multiple case studies in this thesis is that of replication. Thus, each case was selected so that it either produces similar results or for theoretically predictable reasons produces contrary results. The multiple cases in this study also underline the complexity of the problem under investigation. The study therefore focused on the case-study organisations as units of analysis.

In selecting the case-study organisations, certain factors were considered. According to yin (2003), four main factors relate to the selection of case-study organisations, namely;

- Relevance; which refers to the extent to which the selected organisation suits the purpose of the study;
- Feasibility; which refers to the practicability of the research being conducted. The researcher should be able to conceptualise, plan, execute and report back on the research project. The case organisation should be within the reasonable reach of the researcher in terms of distance and that the researcher should have the appropriate managerial and operational support to ensure a successful completion of the project;
- Access; which requires that the full co-operation of the organisation should be secured for the duration of the research. Accessibility also requires that the nature of business of the case-study organisation should be non-security sensitive and they should be willing to participate in the research at both executive and operational level; and
- Applicability; which refers to the extent to which the case-study method can be applied in a particular situation.

In terms of relevance to this study; the case-study organisations (targeted universities) had such characteristics as residential housing and classroom blocks for students' residence and

learning respectively; large employee population and interest in building facilities management. In relation to feasibility; the case-organisations were located within the same geographical zone or area as the researcher's home base. Thus, the appropriate managerial and logistics/operational support to ensure a successful completion of the research was assured. For accessibility; the co-operation of the case-organisations was secured for the conduct of the research.

The nature of business and the research was non-security sensitive. Besides, as a member of staff of one of the case-study organisations, securing approval and participation at both the executive and operational levels was a lot easier. In relation to the applicability of the research and the extent to which the case-study method can be applied, factors such as size of the case organizations (federal government owned universities in the zone with large student and employee populations were considered as units of analysis); industry sector (nature of business focuses on service-type organisations rather than industrial-type organisations); and the status of the focus on building performance evaluation and facilities management were considered.

However, the primary defining feature of a case-study is the fact that there is a multiplicity of perspectives rooted within a specific context (Snape and Spencer, 2003:52). In this research, the multiplicity of perspectives lies in the fact that the stakeholders in the study experienced the performance of buildings and evaluations in different ways.

According to Gossaye (2001), the case approach provides opportunity for the investigator to apply a range of data collection techniques and use evidence from multiple sources. Although case-studies may be used in their own rights, it is more often recommended as part of a multi-method approach. Gossaye's (2001) view supports the mixed method adopted for this research in section 4.8.3. A strong appeal for the case-study alternative in this study was the opportunity it provided to examine in-depth the links between the performance evaluation systems, building facilities management and organisational processes which the literature review suggested. Furthermore, the involvement of both quantitative and qualitative data in the research pointed to the use of the case-study design alternative. The research design was characterised by an iterative process using concepts and ideas from both the theoretical literature and empirical data from the field. The structural framework for the execution of the research is represented in Figure 4.2.

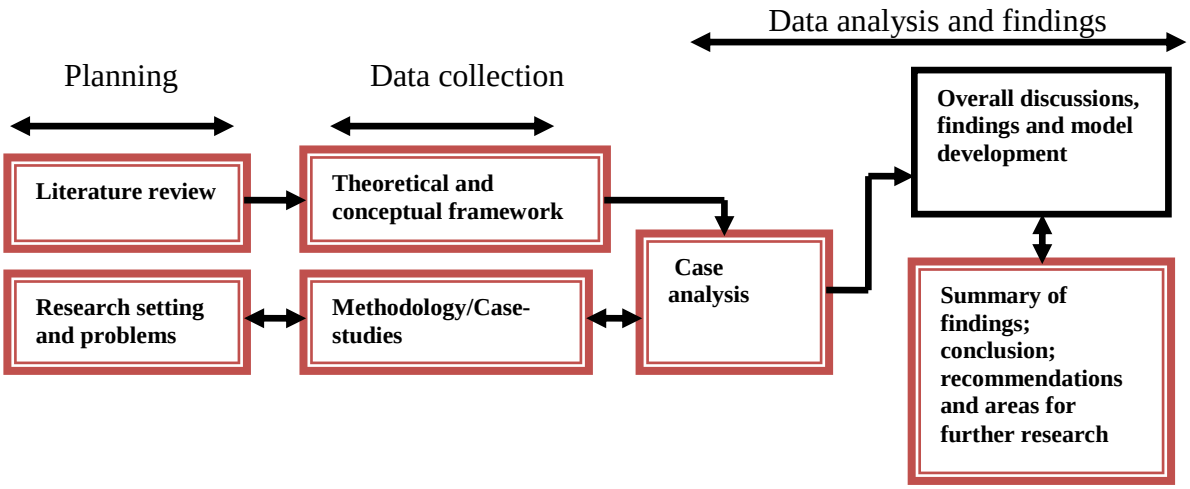

Figure 4.1 General structure of research design

Given that this research focuses on user needs/requirements and the performance of buildings in educational institutions, appropriate research instruments were required to capture field data for the analysis. These are discussed in the next section.

4.9.4 Data sources, collection instruments and field-work

There were multiple data sources for this research. Basically, they were classified into two; primary and secondary data sources. The primary data was generated from the field-work/case-studies while the secondary data was sourced from official records, previously conducted studies, book publications, maps/images, journal articles, newspapers, reports and assorted documents. Most of the secondary data sources were captured in the literature review. However, the primary sources and other secondary sources/instruments are provided in this discussion.

Under the case-study approach, a wide variety of data collection methods are available. These include questionnaires, interviews, focus group discussions, observation and walkthroughs, literature review/documentation and artefacts. Thomas (2006:69) identifies three main types of data collection methods as:

- Asking questions and listening intensely to the answers;
- Observing events and noting carefully what happens; and
- Reading documents.

The possibility of using more than one of these methods is suggested by Gillham (2000:13) who states that "case-study is the main method. Within it different sub-methods are used: interviews, observations, document and record analysis...and so on." Saunders *et al.* (2000) in their discussion on the multi-layer approach to research list questionnaires, interviews and observations as data collection instruments. Data collection methods, instruments or techniques are not research methodologies as explained in sections 4.3 to 4.6.2. They can therefore be used with more than one methodology.

This research was designed as a multiple case-study with a mixed method of data collection already discussed in section 4.8.3). Data collection instruments in the study include questionnaires, focus group discussions, interviews, observations/walkthroughs, archival records, recordings, and photographs. Some of these instruments were qualitative, and others quantitative. The qualitative instruments (focus groups, interviews) were concerned with the experiences and perceptions of the stakeholders (staff, students, clients, designers and facilities managers) about the performance and management of educational buildings; while the quantitative instruments (questionnaires) were concerned with issues relating to the ranking of building performance indicators as identified in the literature. The quantitative tools also measured the opinions of the larger number of students and staff in the target universities or case organisations. The aim here was to allow one set of instruments to verify or refute the other. Each of the data collection methods was considered as part of an overall approach towards improving the quality and validity of the research data by an approach called triangulation.

Triangulation is an approach intended to increase the quality and validity of research. It is used to provide a confirmation of the research process. Patton (2002; Easterby-Smith *et al.*, 2008) advocate the use of triangulation to avoid bias by the researcher; either in terms of the influence the researcher has on the behaviour of participants or bias personally brought into the conduct of the research by the researcher. This study was designed to use triangulation as part of the empirical data gathering process. Four types of triangulation were explored in this research, namely; data triangulation, investigator triangulation, theory triangulation, and methodological triangulation (Neuman, 2000; Millerand Brewer, 2003; Babbie, 2005).

- Data triangulation refers to the collection of multiple data sources to obtain views about a particular topic. It involves time, space and persons. In this research, these include published materials available from the case-organizations, focus group

interviews conducted with the case-study participants, observations and walkthroughs by the researcher and other documents related to the topic;

- Investigator triangulation consists of the use of more than one observer and in this case, more than one observer appointed by the case-organisations ensured the integrity of the data gathering process by the researcher;
- Theory triangulation refers to the use of more than one theory in interpreting a phenomenon. This was achieved through the use of the various theories of building performance evaluation; various research theories and data collection processes/ approaches as part of this research; and
- Methodological triangulation which refers to the use of more than one method in a research and each tapping from the rich dimensions of the other. This was achieved through the use of mixed methods and a variety of data gathering tools/instruments.

The approach adopted by the researcher was to conduct an exploratory study of the field setting with the aim of familiarising with the eventual respondents, establishing relevant contacts and securing the co-operation of staff and students in the target institutions. This involved discussions and exploratory interviews with key workers in the departments having responsibilities to design and manage building facilities. An introductory letter (**see Appendix 3**) explaining the purpose of the research and the benefits to be derived was earlier delivered to the target universities by the researcher. The academic nature of the research was also explained to allay fears that the research may have political undertones. A detailed discussion of the role of each data collection instrument employed in this case-study is provided in the following sections.

4.9.5 Questionnaire surveys

Questionnaires are data gathering devices designed to elicit answers or reactions to pre-arranged questions presented in a specific order (Nahiduzzaman, 2006). The quality of questionnaires depends on the frankness of the subjects' responses and they can be adapted to a variety of purposes, research designs and populations. Very little is available in literature on the use of questionnaires in qualitative research; particularly, case-studies. This is probably because questionnaires are seen as quantitative and not qualitative data collection instruments (Thomas, 2006).

Questionnaires are of little value if meaning and understanding are the primary concerns. Nevertheless, Gillham (2000:78) states that questionnaires have some value in case-studies when straightforward and fairly accurate information is required from a large population. In this study, as much information as possible was required from a large population of staff and students in the target universities. The questionnaires designed for the study are both structured and semi-structured. The structured questionnaires include simple (multiple choice) and closed questions; while the semi-structured questionnaires include both open ended and close-ended questions. The open-ended questions allow respondents to freely express their opinions and views without prejudices so that adequate information can be obtained in relation to the objectives of the study.

Describing the different dimensions of questionnaires, Gillham (2000: 59-60) states that although questionnaires are not usually used in case-studies, they are classified as the most structured end of the questionnaire continuum. Table 4.5 shows the different dimensions of the questionnaires in a case-study research.

Table 4.5 Data collection instrument within the structured/unstructured questionnaire continuum.

Unstructured						**Structured**
Listening to other people's conversations	Using natural conversations to ask research questions	Open-ended interviews with a few key open questions	Semi-structured interviews . That is; open and closed questions	Recording schedules and verbally administered questionnaires	Semi-structured questionnaires: multiple choice and open questions	Structured questionnaire: simple, specific and closed questions

The objectives of the questionnaires in this study include:

- To provide descriptive information about the target universities with a view to illuminating demographic, educational and operational context of the institutions' physical (building) facilities, design and performance objectives;
- To collect data from students and staff on the objective/quantitative as well as the subjective/qualitative aspects of performance in educational building spaces;

- To better understand how staff and students perceive performance of building spaces in terms of accessibility, use of teaching and learning spaces, comfort, safety, security and maintenance;
- To examine statistically significant predictors of building performance in the target universities; and
- To direct attention to the observations within the target universities.

The design and development of the questionnaires followed three stages, namely;

- Exploration of the areas/issues to be included;
- Question wording and sequencing; and
- Physical design layout.

The questionnaires were pilot-tested with two Federal universities in the Southern part of Nigeria from 21st May to 6th June 2010. These universities were not part of the sample under investigation. The feedback from the pilot survey showed that the respondents had few questions for clarification and little or no difficulty in understanding what was required. However, their views on some of the items were noted and the necessary changes made. These included few spelling corrections, response choices and personal information. The feedback/results obtained from the pilot survey were used in the design of the final questionnaire for the field study. Two categories of questionnaires were developed; one for staff and students and the other for service providers/designers. The questionnaires named 1 and 2 (**see Appendices 2 and 3**) comprised fixed response (multiple choices) and open-ended questions.

The questionnaires were divided into two sections. The first section requested data and information on location and other demographic issues such as telephone numbers, experience, position/status and gender, number of employees, type and ownership of buildings. The second section elicited response on building performance practices of the target universities with particular reference to the performance aspects/measures identified in the literature. These include functionality (space, fitness for purpose, accessibility and maintenance), health, safety, environmental concerns (temperature, ventilation, lighting and noise), productivity, aesthetics and cost effectiveness.

Directors of physical planning, works, and designers/managers were requested to provide information on location, type and ownership of buildings, funding and management of the university buildings/residential houses, construction and maintenance, spaces and environmental services. The academic staff and students on the other hand provided information on accessibility, learning spaces, comfort, security and safety. All the questions were designed as closed questions where response alternatives were used. Open ended questions on constraints faced by the institutions, suggestions and opinions on how to improve building performance practices were also included in the questionnaires. All the suggestions and opinions were transcribed by the researcher.

4.9.6 Observations/walkthrough

This may also be referred to as direct observations. It involves observing the workplace relationships among workers/people and work processes/procedures and recording, describing, analysing and interpreting the research subjects' behaviour (Nongiba, 2008:110). Observation has been recognised as a valuable method of data collection by authors (Saunders *et al.,* 2000; Gillham, 2000; Yin, 2003; Babbie, 2005). They argue that observations complement interviews as additional sources of data and can take place on both informal and formal basis. However, there are three types of observations, namely;

- Structured observation;
- Participant observation; and
- Tracing/unobtrusive observation

Structured observation is a technique where an observer systematically and quantitatively records where and when certain behaviour occurs in a specific setting (Barrett and Baldry, 2003:133). It may be used over a day, a week, or a month. Such records allow the observer to construct which areas of a building are under-utilized by what sort of people, in what ways and at what times. This helps the construction/facilities manager to know if such spaces could be more productively used for something else.

Participant observation originates from the field of ethnography involving the participation of the researcher in the everyday life of a social setting (Coffey, 2006:214).Tracing or unobtrusive observation means observing physical traces or systematically looking at

physical surroundings to identify the reflections of previous activity not produced in order to be measured by the researcher (Barrett and Baldry, 2003). Traces may consciously or unconsciously be left behind by employees or people in their surroundings or organisational setting. For examples, paths across a field and door blinds or curtains left over an open doorway.

This technique enables the researcher to ascertain how people actually use their environments or spaces where they work or live. It also helps the researcher to know how many changes the employees make in their workplaces in order to meet their particular requirements or needs. Observations may be recorded with photographs, diagrams, drawings and numbers. The technique must be used in conjunction with other techniques to avoid false assumptions. Barrett and Baldry (2003:144) maintain that four classes of observation which can be used by researchers and facilities managers include;

- By-products of use; which allows the researcher to establish if people use spaces for the purposes they were initially designed. These include erosions, leftovers, and missing traces. For examples, worn away areas in a building, indicating more use than it was originally designed, occurrence of unplanned activities such as cigarette stubs left behind in a washroom, and coffee/rest areas without empty cups or magazines;

- Adaptations for use; which occurs when people notice that the physical environment or space does not allow them to do what they want to do. Sometimes they become designers and change their surroundings. These include props, separations and connection of spaces. They demonstrate how people would choose to design their own environments if consulted. For example, addition to a setting to allow for new activities due to changes in the function of a room/space, separation of spaces that were previously together/partitioning or adaptation of spaces to allow for increased movement in spaces that were previously separate;

- Displays of self; which arises when people change their environments for privacy. Spaces designed without personalisation may result in workers who are not satisfied with their surroundings and this may have detrimental effect on their work or how they view their organisations. Displays may be in form of personalisation or identification. For example, use of space for personal possessions such as photos,

books or certificates or placing of temporary name plates on partitions. This suggests that new designs should make provision for such things as fixed name plates; and

- Public messages; which is the communication of specific messages to the general public through physical environments. This may be in official or unofficial forms. For example, visitors may be restricted from entering certain areas by the use of private signs or frequent appearance of the organisation's name around a building, unofficial direction signs written on paper and pasted around the building. This shows that the official direction signs are inadequate and should be provided in subsequent designs.

This research adopted both the structured observation and tracing/unobtrusive observation techniques for the case-studies. The observations/walkthroughs were conducted separately as well as during the administration of questionnaires and interviews as scheduled. This provided the researcher the opportunity to physically measure and observe the buildings and spaces in relation to the identified performance aspects/design objectives. It further helped to identify additional artefacts and documents as part of data collection activities. The walkthrough provided the researcher with first hand information on the use of building/spaces by staff and students in the target universities. The visual documentation of these situations in the target universities were captured in photographs and drawings as presented in chapter 5.

4.9.7 Focus group discussion

Due to the exploratory nature of this research, focus group discussion was used. Babbie (2005:89) explains that exploratory research is undertaken when a researcher examines a new interest or the subject of study itself is relatively new. Babbie (2005) maintains that this is sometimes investigated through a focus group discussion in order to achieve the following:

- Satisfy the researcher's curiosity or desire for better understanding;
- Test the feasibility of undertaking a more extensive study; and
- To develop the method to be employed in any subsequent study.

Building performance evaluation is still a developing field of knowledge in Nigeria and due to the tenuous nature of research in this area, focus group discussion was considered appropriate for the study. Focus group discussion, sometimes called group interviewing is largely a qualitative method of research based on structured, semi-structured or unstructured interviews. It provides the researcher an opportunity to question/interview a group of people

together thereby prompting a discussion (Babbie, 2005:316). As a data collection instrument, it gathers people from similar backgrounds or experiences together to discuss a specific topic of interest to the researcher. Words such as organised discussion, collective activity, social events and interaction differentiate focus group from other types of interviews.

The focus group research draws from the attitudes, feelings, experiences, reactions and beliefs of the respondents which would not have been possible if other methods, for example, observation, face-to-face interview or questionnaire surveys were used. Babbie (2005) suggests that in atypical focus group discussion, 12 to 15 people are brought together in a room to engage in a guided discussion of a topic and by sharing their experiences with one another, the researcher obtains richer data sources than the questionnaires. The subjects or participants are selected on the basis of relevance to the topic and are not likely to be chosen through rigorous probability sampling methods. This implies that participants do not statistically represent any meaningful population. The focus group discussion is intended to explore, rather than to describe or explain in any definitive sense.

In this study, the focus group interview was intended to gauge the thoughts and honest opinions of staff and students towards the performance of buildings in the targeted institutions. This provided detailed information as the participants gave their own opinions as well as listened to others. The focus group discussion further explored in greater depth common and conflicting issues addressed in the student and staff questionnaires. One focus group interview (**see Appendix 7**) was conducted for each of the case-study universities comprising the staff and students. In each of the group meetings, an independent observer/moderator (**see Appendix 6**) who was also a staff of the institution moderated/facilitated the groups' discussions. The purposive sampling technique was used to select the right mix of participants. The researcher was objective by avoiding voluntary attendance and being careful about dominant or intimidating personalities in the discussions. The researcher was also present but did not participate in the discussions in order to allow the participants air their views freely. Student participants in the focus group meetings were full time resident and final year students who were knowledgeable in the use and operation of residential buildings in the target universities. Staff participants were diverse in terms of gender and qualifications.

Twenty (20) participants (staff and students) drawn from departments and faculties were invited in each of the case organisations through an invitation letter (**see Appendix 4**). In the end, fifteen (15) participants attended the meeting in each of the institutions. The number of participants was deliberately limited to 15 in compliance with the size of a typical focus group meeting (Babbie, 2005). It is important to note that the size of focus group meetings depends on several issues such as the sensitivity or complexity of the population under study and the depth of data needed by the researcher. However, the focus groups were focused because the members shared one common interest- the desire to live and work in buildings that meet their needs.

As a developmental data collection process, one focus group interview was used as a basis for the next data collection process. Data was therefore collected at different stages of the study. The schedule of data collection instruments, the target participants and dates for the focus group interviews in the case-study organisations are provided in Table 4.6.

Table 4.6 Schedule of data collection instruments for the case-studies

Instrument/Tool	Group/Participants targeted	By whom	Date and duration	Case-study organisation
Focus group discussions	Staff and students	Researcher and observer	10 June 2010 (1-hour)	Case-one
Questionnaire1: structured and interviews	Staff of physical planning, works and designers	Researcher and assistants	12 June 2010	Case-one
Questionnaire2: semi-structured and interviews	All students and staff in the case	Researcher and assistants	17-18 June 2010	Case-one
Focus group discussions	Repeat target group	Same as above	21 June 2010	Case-two
Questionnaires 1 and 2 and interviews	Repeat target group	Same as above	24-30 June 2010	Case-two
Focus group discussions	Repeat target group	Same as above	1-3 July 2010	Case-three
Questionnaires 1 and 2 and interviews	Repeat target group	Same as above	6-12 July 2010	Case-three
Focus group discussions	Repeat target group	Same as above	14-16 July 2010	Case-four
Questionnaires 1, 2 and interviews	Repeat target group	Same as above	19-25 July 2010	Case-four
Observations/walkthrough and informal discussions	Bye-products of use, adaptations for use, displays of self and public messages in Building facilities	Researcher	26-30 July 2010	All cases

4.9.8 Interviews

Interviews are carried out to source information. According to Patton (2002), interviews may be based on:

- Informal conventional interview; which refers to interviews designed in such a way that questions emerge from the immediate and are asked in the natural context;
- Interview guide approach; where topics and issues are specified in advance but the sequence is decided by the interviewer; and
- Closed fixed response interview where questions and response categories are fixed and determined in advance.

In this research, the interview guide approach was used. The interviews were conducted with the staff in the targeted universities. The personal or face-to-face interviews provided the researcher with the necessary information regarding:

- The respondents' views on the performance of buildings in the target universities;
- The impact of building performance on teaching and learning effectiveness in the target universities;
- Level of building performance evaluation in the target universities; and
- Impediments/hindrances to building performance evaluation in the target universities.

The interviews were unstructured and semi-structured to enable the researcher obtain clarifications of some variables which needed further in-depth investigation. They included the informal mode of interviews due to the sensitivity of some of the issues in the study. This helped to remove bias arising from respondents who could have given false information to portray the universities in good stead. The semi-structured interviews adopted for the study also allowed meanings and perceptions of building performance evaluation to be generated in line with the subjectivists/constructivists mode of creating knowledge in the study context.

The questions were designed to gather information on the approach to building performance evaluation practices, role of the stakeholders, strategies and challenges to building performance evaluation in the institutions. The interviews adopted a conversational style starting with an opening question to prepare the interviewee for further questions. Main questions were on key issues. This was followed by questions probing the answers offered (**see Appendix 9**). The conversational style adopted facilitated the discussion of topics which,

in the opinion of the interviewees were important. Further probing questions explored emergent issues such as institutional/government policies and attitudes to building performance evaluation. The interviews were concluded by asking the interviewees to talk about other issues which might not have been covered by the researcher's questions. Interviews continued until respondents' responses did not yield any further new information or additional ideas. Simply put, the interviews were saturated. The interviews lasted between forty five to sixty minutes with each participant and were tape-recorded. A graphical representation of the interview process is shown in Figure 4.3

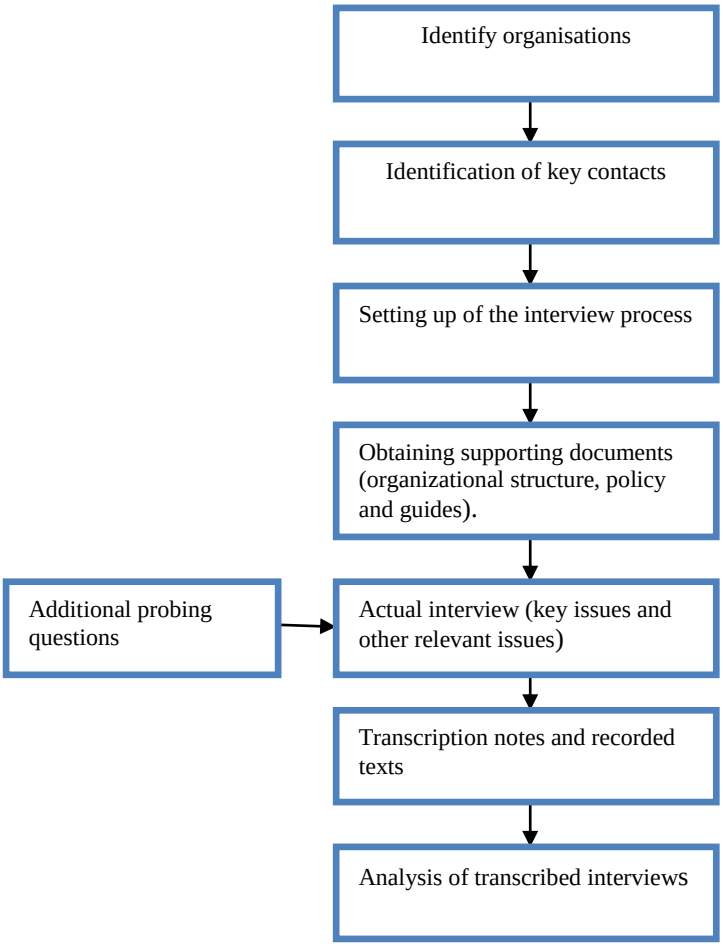

Figure 4.2 Interview process

4.9.9 Study population and sampling technique

A study population is that aggregation of elements from which a sample is actually selected. A sample on the other hand is that element or set of elements considered for selection in a study (Babbie, 2005:196). The nature of research and study population largely determines the

sample to be selected. In this research, the population under study can be defined as staff, students, design and building managers, residential, office and classroom buildings in the four federal universities in South East Nigeria.

Given that the research is a multiple case-study, an appropriate sampling technique was required to balance the objectives of the study and data requirements. Blaike (2003:166) states that the accuracy of estimates of population parameters depends on the sample size. For this reason, the general rule of sampling is the larger the better. This implies that a larger sample produces a smaller sampling error than does a small sample. The stratified random sampling technique is a commonly used probability sampling method which is superior to simple random sampling because it reduces sampling error. According to Eze, Obiegbu and Jude-Eze (2005:15), stratified random sampling involves the study of large heterogeneous populations grouped into strata or blocks. The grouping is done in such a way that each stratum or block is as homogeneous as possible. Then, each stratum is sampled at random, using the same or different proportion. Stratification therefore refers to the grouping of units composing a population into homogeneous groups or strata before sampling. This procedure may be used with random, systematic or cluster sampling (Babbie, 2005:212). Babbie (2005:214) illustrates that this technique improves the representativeness of the sample in terms of variables used in the stratification and can be used to select a sample of university students.

In this research, the sampling approach adopted followed a sequential process (Teddlie and Yu, 2007), involving first, a stratified random sampling for the administration of questionnaires in the survey aspect of the study. This was followed by the purposive sampling technique for the selection of participants in the focus group discussions and interviews. Purposive sampling is a non-probability technique that selects informative subjects or units of observation as a representation of the wider phenomenon under investigation. Time, cost and small sample needed for the focus group interviews were the special circumstances that applied to this research and therefore made the purposive sampling technique appropriate. The sampling frame for the focus group was lists or records of full time final year students resident in the university accommodations, full time staff that have spent at least two years of employment in the targeted universities; residential, classroom and office buildings completed and occupied for at least twelve months within the last fifteen years, designers/building managers engaged by the targeted universities. For the interviews,

the sampling frame was staff of works and physical planning departments in the targeted universities.

A sample frame according to Babbie (2005) is the list or quasi list of units composing a population from which a sample is selected. The sampling frame consisting of the above groups of people and buildings were drawn across the faculties and units; and from the sample frame, a sample group was selected for focus group discussion, questionnaires administration, interviews and observation. A total of one hundred and seventy questionnaires (170) were distributed and the researcher was present during the completion of the questionnaires to clarify any ambiguous issues. The sample groups were considered by the researcher to have gained adequate knowledge and experience of both the residential and classroom buildings (students); office buildings (staff); design and management of educational buildings (designers/managers) in the targeted universities.

The researcher also considered buildings occupied for at least twelve months to have operated for a full seasonal cycle (summer and winter). The primary selection criteria for the buildings were therefore period of occupation and fifteen years of age. A total of 87 buildings comprising of 25 from university A; 17 from university B; 30 from university C; and 15 from university D were sampled and studied. This represents about 37 percent of the total building stock owned and managed by the case organisations. Details of the surveys and distribution of buildings provided and managed by the case organisations are discussed in chapter 5.

4.9.10 Data validity, reliability, ethics and limitations.

It is considered good practice for researchers to demonstrate the credibility of their data collection, analysis and findings. They must provide sufficient information on the methods used in the research and justifications for their use. To evaluate the credibility of research findings; validity, reliability and ethical issues are commonly used as criteria (Saunders *et al.*, 2000). Validity refers to the degree to which the findings of a research are interpreted in a correct way. Put differently, validity determines whether the identified inputs within their attributes actually produce the expected output or result (Sutrisna, 2009). It is the extent to which the results of a study can be verified against the stated objectives.

Reliability on the other hand refers to the consistency of results obtained in the research. Simply put, it is the reliability of the method for data collection or the degree to which the findings of research are independent of any accidental circumstances.

Validity may be content, construct or criterion related while reliability issues include scoring agreement, test, equipment forms and internal consistency. Reliability is achieved when the same research process is repeated and reproduces results within the stated confidence limits. Eriksson (2002) states that reliability of an investigation is satisfactory if another researcher conducts the same research and draws the same conclusions. Thus, reliability deals with the quality of data and this requires the triangulation of the various sources of data which provide similar results from different angles. This requires a thorough demonstration of rigour and clarity of research findings. Validity on its part may be evaluated internally or externally:

- Internal validity refers to whether the identified inputs within their attributes actually produce the expected output or result; and
- External validity refers to the extent to which any research findings can be generalised or extrapolated beyond the immediate research sample or setting in which the study took place.

The instruments for this study were designed to reflect the above issues and therefore intended to capture all necessary information to accomplish the research. A major criticism against the use of questionnaires is the fact that they may lack validity. Respondents may interpret questions in a different way from what was intended especially when ranked responses are asked. Again, respondents may not be totally honest in their answers (Miller and Brewer, 2003:155). To overcome this problem, the researcher pilot-tested the questionnaires on a small sample group and personally administered them. The findings were intended to demonstrate rigour and also repeatable within the context of facilities and construction management.

Although the limited number of case organisations for the study does to some extent limit the reliability of the research, it is expected that the combination of many research instruments will minimise this shortcoming. Another reliability problem such as observer bias was minimised by the involvement of only one observer in the field work. This ensured a high level of consistency in the nature of data collected. Furthermore, the research was designed to ensure a maximum degree of objectivity within the scope of the study. This was achieved through the use of triangulation as discussed in section 4.9.4

Ethical issues in research concern the appropriateness of the researcher's behaviour in relation to the rights of the research subjects or those who are affected by the research (Saunders *et al.,* 2000). This means that the subjects affected by the research must have been given the opportunity by the researcher to give free and informed consent about participation. Free and informed consent therefore lies at the heart of ethical research involving human subjects. In this research, all the case organisations that form the basis of the study provided consent. No case organisation was named and the identities of individuals or groups of people were not disclosed. Simply put, all subjects in this study were anonymous.

4.10 Generalisability

This is the extent to which the findings and conclusions of research conducted on a population sample can be generalised or extended to the entire population. Generalisability is based on the frequent occurrence of a phenomenon and so when there is sufficient data to support the validation of a hypothesis, a premise exists to generalise the behaviour of such data in similar circumstances. However, due to its foundation in probability theory, generalisation cannot be regarded as conclusive (Shakantu, 2004:185). Generalisability is more applicable in quantitative research involving large samples than qualitative research. The rule is, the larger the population sample, the more the results tend towards generalisation. The adoption of mixed methodology involving both quantitative and qualitative data addresses the issue of generalisability of findings in this research.

4.11 Chapter Summary.

This chapter presented the methodology adopted for the conduct of this research. It also provided the justifications for the philosophical position and methods of data collection. The research design described in this chapter has linked three important elements of the research methodology, namely; the underlying philosophical assumptions; the research methods/approach; and data collection techniques. Issues relating to validity and limitation of this research have been discussed. The next chapter presents the units of analysis or the 4 case-organisations observed for this research.

CHAPTER 5: Case studies, Data Presentation, Analysis and Results

5.1 Introduction

In this chapter, the researcher presents the case study organisations in the study. The first section introduces the case organisations and presents data, narratives and quotations obtained from the focus group discussions in the study setting. Exploratory interviews conducted with senior staff in the building and physical planning units whose functions centre on the management and evaluation of buildings are also presented. The results are discussed from the view-point of institutional stakeholders and the general environment within which performance evaluation of buildings takes place. These interviews and focus group discussion meetings provide a good complement to the questionnaire study presented.

The second section of this chapter presents the results of questionnaire surveys administered to respondents. The results are presented as descriptive summaries of the data on building performance evaluation. Inferential statistics are used to evaluate the key hypothesis postulated for the study. Due to the exploratory nature of the study, a relatively small data set was used for the statistical treatment of the hypotheses. Walkthrough and observation results; opinions and suggestions by respondents on how to improve the performance of buildings are presented in the subsequent sections. Tables, figures, charts and photographs will be extensively used for data presentations, analysis and interpretation of results. Section 5.2 introduces the case studies.

5.2 Case studies.

In this research, the four (4) case organisations (case studies) are explained in terms of location, organisational profile; nature and type of building facilities services provided by the institutions. Thereafter, the research process and presentation of results follows. To respect the anonymity of the institutions and for ethical reasons, the case organisations will be referred to as universities A, B, C and D respectively.

5.2.1 University A

University A is a conventional University established in 1992 and located at Awka; the capital city of Anambra state in the South-Eastern part of Nigeria. It is approximately 1 hour

drive from Onitsha; one of the major cities in Nigeria. The approach and aerial views of University A are shown in Figures 5.1 and 5.2 respectively.

Figure 5.1 Approach to the entrance of University A

Figure 5.2 Aerial view of part of the buildings of University A

5.2.1.1 Organisational Profile and services provided

University A claims to be founded on the philosophy that knowledge should be propagated and disseminated to individuals without any form of hindrance. The mission of the University therefore is to use teaching, research and public service to solve societal problems. The tenets of the University's motto are anchored on "Discipline, Self Reliance and Excellence". The rationale for this motto is that a disciplined mind with self confidence yields excellence. The University has a population of over twenty thousand students for both full time and part time programmes. The programmes are organised into 10 faculties, namely;

- Faculty of arts;
- Faculty of education;
- Faculty of engineering;
- Faculty of environmental sciences;
- Faculty of Health sciences;
- Faculty of law;
- Faculty of management sciences
- Faculty of medicine;
- Faculty of natural sciences; and
- Faculty of social sciences

Other departments and units exist in the non-academic section of the university including the academic and physical planning units; and building and works department. The staff strength is over nine thousand. Various development schemes and investments are already placing the institution as a leading University in South East Nigeria. The building and physical planning units design and manage the university buildings and provide a wide range of services that are essential to the development, operation, maintenance and care of estate premises, including engineering services. The university has a large estate but relatively little residential accommodation for the students. This is probably because it was initially established as a non-residential institution. The efficient operation and management of buildings therefore constitute a challenge to the varied age and suitability of the premises. A significant proportion of the university's annual budget (about 12 percent) is spent on the development and maintenance of capital projects.

The physical planning and works departments are concerned with:

- Providing a safe, secure and pleasant environment in which to work and learn;
- Design, operation and maintenance of buildings;
- Care of students, staff and visitors to the university;
- On-going review, updating and implementation of the university's accommodation strategy; and
- General provision and management of building/estate services.

The built-up area of the university has increased approximately by 40 percent over the last five years (2005-2010). However, according to reports from the budget unit of the institution, this has not resulted in corresponding increases in internally generated revenue.

5.2.2 University B

University B is one of the Federal Universities of Technology set up on a regional basis by the Federal Government of Nigeria in the early 1980s. It is located at "Ihiagwa" south of Owerri; the capital city of Imo state, in the South Eastern part of Nigeria. The university is surrounded by some villages and lies between two major trunk roads; Owerri –Aba road and Owerri-Port Harcourt road. A new road connecting these two major roads passes through the university site and therefore serves as the university approach route. A major tributary of the Imo River (the Otamiri River) traverses the campus from North to South. The entire campus covers an area of over 4000 hectares. Figures 5.3, 5.4, and 5.5 show the various views of the university campus, the Otamiri-river and a linking bridge respectively.

Figure 5.3 Northern part of university B.

Figure 5.4 Otamiri River traversing University B

Figure 5.5 Otamiri-river Bridge linking North and South parts of university B.

5.2.2.1 Organisational profile and services provided

As a University of Technology, University B has over the years grown into a centre of learning encompassing many disciplines including Agriculture, and Agricultural Technology; Engineering and Engineering Technology; Sciences (Natural and Applied); Management Technology; Health Technology and General studies. The university claims to place a lot of premium on helping students to acquire practical experience and appropriate technological skills needed for human development. There are well over twenty thousand students pursuing various academic disciplines at undergraduate and postgraduate levels. The staff strength is about eight thousand. Part of the university's strategic goal is to create quality academic

gender sensitive and conducive working environment. Its mandate therefore is to identify technological problems and needs of the society and find solutions to them within the context of overall national development.

The estate and works department, in conjunction with the physical planning unit have worked as a team in developing the university campus for the past six years. The estate and works department is responsible for the maintenance, refurbishment and remodelling of existing building infrastructure in the university. The department therefore claims to follow a design brief that reflects the realistic aspirations of a university of technology with an understanding of its students and staff needs. The core services provided by the physical planning and estate and works department include:

- Building and engineering services;
- Measurement and drawings;
- Property portfolio management; and
- Maintenance management.

The university's overall strategy is to ensure that the organisational aims and objectives are met by providing the highest quality of services in terms of building facilities management, maintenance and development. All the services are provided by a multi-disciplinary team of professionals who recognise the value of providing a quality environment for staff and students.

5.2.3 University C

University C is a conventional University located about eighty kilometres North of Enugu; the administrative capital of Enugu state in the South-Eastern part of Nigeria. The area is predominantly savannah grassland with isolated patches of trees and has a pleasant and healthy climate. Figure 5.6 shows part of the University campus.

Figure 5.6 Part of the campus of University C.

5.2.3.1 Organizational profile and services provided

University C was founded on the concept of service to man primarily to meet the developmental needs of the society. University C has a population of over twenty two thousand students and staff strength of about seven thousand. The basic objectives of the university are to seek, teach and preserve the truth**.**

The works services department is the engineering and maintenance outfit of the University comprising of 10 (ten) sections created for easy day- to-day administration of the department and effective service delivery. The works services department provides professional facilities management services to the university to enable the academic and support services continue in a safe and efficient manner. This creates the necessary environment which facilitates social and work conditions for staff, students and visitors to the university. The department therefore carries out land administration, ground development, and property and maintenance management. The mission of the university is to build a works services department that will be responsive to the demands of the university and offer acceptable service delivery to its stakeholders.

5.2.4 University D

University D is a specialised university of Agriculture set up in 1992 by the Federal Government of Nigeria. It is located at Umudike near Umuahia; the capital city of Abia State in the South-Eastern part of Nigeria. Umudike is popularly known for Agricultural training and research and is about 10 kilometres from Umuahia. The major link road to the University is the Umuahia-Ikot Ekpene Federal road; a direct route to the neighbouring state capitals of Akwa-Ibom and Cross River states in the South-Southern part of Nigeria. Being close to the capital city of Umuahia, the University is linked through a major North-South express road to most parts of Nigeria. Figure 5.7 shows the administrative building of University D.

Figure 5.7 Administrative block of University D.

5.2.4.1 Organisational profile and service provided

University D strives to contribute to Nigeria's greatness through self-sufficiency in food and fibre production as disseminated through teaching, research, training and extension services.

One of the objectives of the University is to develop and offer academic and professional programmes leading to the award of diplomas, first degrees, postgraduate research and higher degrees. The degrees must emphasize planning, adaptive, technical, maintenance and developmental skills in agriculture, agricultural engineering and allied professional disciplines. The aim is to produce socially mature persons with the capacity to improve on those disciplines and contribute to the scientific transformation of agriculture in Nigeria. University D has a population of over twelve thousand students with about four thousand staff.

To achieve the above aim, the works services headed by a director of works is responsible for the maintenance and up-keep of all infrastructure such as buildings, water supply system, electricity distribution system, roads, drains and grounds. The department is responsible for the day-to-day maintenance of students' hostels, classrooms and the University's owned houses. The works and services department also handles utility matters and maintenance of parks and gardens.

5.3 The research/ data gathering process

Having introduced the case organisations in this study, it is now necessary to present and analyse the various types of data gathered from the field studies. Two sets of data were gathered; namely.

Qualitative data; and

Quantitative data

The qualitative data were those obtained from focus group discussions and in-depth interviews. The quantitative data were those obtained from questionnaire surveys and walkthroughs/observations in form of measurements. The coming sections present the qualitative data in form of focus group discussions and in-depth interviews in the case organisations.

5.3.1 Presentation and analysis of Focus group interviews.

One focus group interview for staff and students was held in each of the institutions already described. In all, four group interviews were held in the four case organisations**.** Table 5.1 shows the case organisations and number of participants in each group meeting. Though, 20 invitations were sent out but the researcher limited the number of participants to 15. This was guided by Babbie's (2005) suggestion that 12 to 15 participants should be brought together in a typical focus group meeting.

Table 5.1 Number of participants in the Focus Group Discussions

Case organisation	Location	Number of participants
University A	Anambra State	15
University B	Imo State	15
University C	Enugu State	15
University D	Abia State	15
Total	**4**	**60**

The fact that the questions were open-ended allowed the participants to share as much or as little as they wished about their experiences in the buildings they occupy/use and the effect of those buildings on their work and learning process. Participants were also allowed to discuss their needs and requirements in an ideal building for teaching and learning.

Figure 5.8 Focus group discussion session in one of the universities

All the discussions were recorded on a digital tape recorder and after each meeting; the researcher captured the data on the computer. The captured data were sent to the moderators/observers who attended the meetings in order to vouch for their accuracy and error minimization. The researcher listened several times to the recorded responses, opinions and suggestions and personally transcribed them. Transcribed versions were also sent to the observers who agreed that indeed, an accurate version of the discussions were obtained.

Generally, the following themes emerged from data coding, categorisation and theme identification;

- Design of buildings, teaching and learning environment;
- Stakeholder involvement, and user needs/ value ;
- Adaptable change; and
- Health, security and resource development

5.3.1.1 Design of buildings, teaching and learning environment

It has been stated in section 1.9 that the rationale for this study is to investigate the extent to which performance of buildings enhance or hinder staff and students' performance. Based on this rationale, the following questions relating to the first theme emerged;

- How has the building enhanced teaching and students' learning?
- What do you think is the greatest asset about the design of buildings and learning environment in your institution?
- What would you change about the design of the buildings and learning environment?

There is a strong link between the physical environment of buildings and educational process (Sanoff, 2003; CABE, 2009; Thomas, 2009). A positive interaction between people and buildings enhance the educational process in an educational environment. However, the reactions and comments in relation to these questions show that the design of buildings impact on the educational process. Comments from the participants were not edited for language and therefore presented in quotes. In this regard, the first task in the discussion was to establish if certain attributes of the building design enhances or hinders teaching and learning by staff and students. Participants were asked to discuss what they think is the greatest asset about the buildings and what they wish to change about the buildings. The following attributes were mentioned as greatest assets of the buildings and learning environments:

"We have a digital library"

"I can easily access the library"

"The classrooms have sufficient head-rooms"

"There is good day lighting"

"We have sufficient land for future development"

"Our entrance gate to the campus is visitor-friendly"

Although, these attributes were mentioned as the greatest assets of the buildings and learning environments, the participants felt they were not enough to provide a satisfactory learning and working environment. Comments made by the staff and students showed that they have need for spacious classrooms, common rooms, more friendly and functional buildings, offices, hostel accommodation, more libraries and gyms. Participants noted that the major changes they would like to make about the buildings and learning environments include the following:

"Spaces are not properly linked in most of the buildings"
"The floor finishes are poor"
"Classrooms are not slopped"
"Classroom blocks are too far from each other in the same faculty"
"Environment feels dry with no good landscaping"
"There is no space to display things on the walls"
"Parking lots are not sufficient"

These comments clearly show that spaces in the buildings and environment were not properly co-ordinated. Uncoordinated spaces do not only hinder the effective flow of traffic and communication but also efficient educational process and outcomes. The comments point to the disadvantage of not conducting building performance evaluation exercises during the design process. It was obvious from the discussions that participants were dissatisfied with the above design shortcomings. They lose valuable man-hours moving from one classroom block to the other for lectures because the classroom blocks are far apart. This makes teaching and learning difficult. In one of the institutions, a staff participant captured the situation in the following comments;

"The Government and management of tertiary institutions should be prevailed upon to reappraise the infrastructural needs of educational institutions. The situation on the ground has serious negative implications on the products of higher institutions in Nigeria"

The participants observed that the inadequacy of infrastructural needs and other facilities identified in this discussion impact negatively on their academic achievement. There is need therefore for a robust method of evaluating what staff and students require or need in the

building and physical environment of these institutions to achieve their educational objectives.

5.3.1.2 Stakeholder involvement and user needs/value

The second theme that emerged from the logical thematic grouping is stakeholder involvement and user-needs/value. To address this issue the following questions were asked:

- Were you or someone you know involved in any part of planning or design of the buildings in your institution?
- If so, do you feel your input and the input of others you know were taken into account in the design?

Stakeholders in the design of educational buildings include the clients, staff and students, designers, facilities/building managers and the construction team. Participants' comments show that only Architects and Engineers (design team) were involved in the design of the buildings. This implies that the opinion or input of other stakeholders; particularly, staff and students (who are the end-users of the buildings) were not taken into account. The comments by staff in the group explain the reason for this state of affairs as follows:

> "*Like many other institutions of higher learning in the country, users are not usually consulted when designing educational buildings. The authorities assume that the Architects and Engineers know everything that the user needs in the building design*"

A common opinion among the participants regarding this issue in all the four institutions is that of exclusion in the procurement process of buildings in educational institutions. The universities simply commission the design and construction teams for design and construction respectively and as soon as the projects are completed and handed over to the universities, the buildings are put to use. In most of the institutions, the physical planning and works departments only provide consultancy services, monitoring and evaluation of on-going projects and routine maintenance operations. There were no provisions for building performance evaluation units in these departments.

5.3.1.3 Adaptable change

The third theme that emerged from the groupings was adaptable change. The question relating to this theme was as follows:

To what degree do you feel building facilities in your institution will be adaptable and flexible to change in the future?

This question was intended to find out if the building spaces, particularly, classrooms allow for flexibility and adaptability to changing needs and alternative approaches. There were mixed comments and reactions to this question by participants. Some staff and students shared common views about the adaptability of the buildings while others thought that the buildings were not adaptable. This can be explained by the fact that buildings; particularly classroom blocks in some of the universities were partitioned with solid block walls while in others, they were framed structures with isolated columns which allowed spaces to flow. In this later group of buildings, modifications or changes can take place within the same space function. In the other group of buildings that were not adaptable, the following comment by one of the participants summarises the problem of adaptability and flexibility of buildings in the institutions.

"During the last resource accreditation exercise by the National Universities Commission, we spent a lot of money and time to convert one of our workshops into a laboratory space because light partition walls were not used for the construction of the building"

Adaptability and flexibility actually deals with a design concept that can easily be modified or serve a variety of purposes for a diverse group of people in terms of physical spaces. This means spaces that are easy to modify, serve multiple uses and/or users, accommodate future technologies and are life cycle cost-effective (Robinson and Robinson, 2009:6). In the institutions where buildings were not adaptable, participants were of the view that future design and procurement of buildings must allow for convertibility and versatility of use.

5.3.1.4 Health, security and resource development

The fourth theme that emerged from the data grouping was health, security and resource development. Opinions and experiences of participants were sought on issues relating to

secure design, pedestrian traffic, air quality, ventilation, temperature and natural lighting. In this regard, the following questions were asked:

- *Are you comfortable with the indoor environment of the buildings in the institutions?*
- *Do you perceive your institution to be adequately safe and secure from intruders or other forms of man-made hazards/ human aggressors?*
- *To what degree are you aware that the design and/or management of buildings in your institution consider energy conservation measures or other practices of environmental sustainability?*

According to comments by participants, health and safety conditions were poor. To most of the participants, the indoor environments, particularly office and classroom buildings were uncomfortable. The consensus among students was that proper way-finding and signs were not provided to identify buildings and uses on campus. One of the participants had this to say on the physical condition of their learning environment:

> *"I do not think that the design of the physical environment in this institution complies with any safety and environmental codes. We do not have adequate sanitary spaces, fire safety and emergency lighting in most of the buildings on campus"*

The above statement indicates how dissatisfied the participants are with the level of performance of buildings in the case organisation. The provision of portable water in educational buildings ensures that drinkable water is available to staff and students in an adequate number of locations. Sanitary spaces mean available and separate spaces for male and females including functioning toilets that must also be available in sufficient number and locations. It was noted that building and planning codes/regulations are available in the country but lack of enforcement of these code/regulations is responsible for the lapses.

Figure 5.9 Poor sanitary conditions in one of the university residencies.

5.3.1.5 Summary of focus group discussions

Comments, quotations and opinions from staff and students were used in this discussion to highlight the experiences and feelings of participants about the performance of buildings in the universities under investigation**.** Overall, the participants' experiences and feelings show that interaction between them and building facilities in the universities do not add value to their learning and working experiences. The participants' comments and responses indicate concerns regarding poor space conditions, noise, privacy and poor environmental quality. The negative experiences expressed by the participants in all the thematic groupings point to the need for building performance evaluation system that produces not only buildings that support educational objectives but buildings in which users or occupants are comfortable and productive. The findings show that significant attention is not given to building performance evaluation in the institutions studied. This observation is consistent with the findings in similar studies carried out in the United Kingdom and United States of America. The consensus of opinion among authors is that building performance evaluation has been neglected in the past (Preiser, 1995; Standeven *et al.*, 1998; Cooper, 2001; Lackney, 2001; Leaman, 2004). The review in sections 2.4 and 2.7 point to the above conclusion.

5.3.2 Presentation and analysis of in-depth interviews

Building performance evaluation is an aspect of construction and facilities management. Therefore, it comes under the jurisdiction of works and physical planning departments of the universities under study. The staff members of these departments are predominantly designers and building facilities services providers who are professionally mandated to ensure that minimum standards of service delivery are maintained. These professionals/service providers include:

- Architects;
- Engineers;
- Builders;
- Quantity Surveyors;
- Estate Officers/facilities managers;
- Town Planners; and
- Land surveyors.

A convenient sample of eighteen members of staff from the above group of professionals was invited from the (four) targeted universities for interviews. Out of the eighteen invitees, only seven (39 percent) yielded positive responses and were interviewed as shown in Table 5.2 The rest of the invitees who declined gave reasons ranging from lack of time to being on leave within the interview period.

Table 5.2 Interviewees and their roles in the targeted Universities

Institution	Number of interviews conducted	Building Role of the interviewees
University A	2 (Architects)	Design, monitoring and evaluation of existing and on-going building projects, implementation of building laws, contract administration.
University B	2 (Engineer and Quantity Surveyor)	Construction works, contract administration, valuation and maintenance works
University C	1 (Estate/Facilities manager)	Direct labour procurement of buildings (in-house), contract administration, maintenance services, monitoring and evaluation of building projects.
University D	2 (Architect and building officer)	As in A above including maintenance

The interviews were conducted with seven actors or respondents occupying key positions in physical planning and work departments of the universities. The questions were structured to provide data and information from the experiences of respondents on critical aspects of building performance evaluation practices; challenges to the conduct of building performance evaluation; benchmarking tools and strategies for improving the performance of buildings in the targeted universities. The results and analysis of the responses are presented using tables, descriptions and narratives as follows:

5.3.2.1 Status of interviewees and nature of department in the universities

A question on this was asked to establish the background and primary organisational nature of the interviewee's department in the organisation**.** Table 5.3 shows the results obtained

Table5.3 interviewees' status and nature of department/professions in the universities

Director of works		Chief engineer		Quantity surveyor		Estate/facilities manager		C/Architect		Other		Total	
No	%	No	%	No	%	No	%	No	%	No	%	No	%
2	29	1	14	1	14	1	14	2	29	-	-	7	100

5.3.2.2 Involvement in design, management and construction of buildings

Table 5.3 further shows that the interviewees were drawn from design, construction, management and maintenance teams respectively. Responses from the interviewees show that estate and works departments are responsible for the management and maintenance of buildings in the targeted universities but not involved in the design process. These departments are grossly under staffed considering the number of buildings under their care and management. This further shows that priority is not given to building performance evaluation as this activity falls within the facilities and maintenance management functions of estate and works departments**.**

5.3.2.3 Building performance evaluation practices and feedback mechanism

The respondents were asked to describe their key measures for judging the success of a new building project after the building has been completed and occupied**.** The interviewees gave a range of responses, but generally referenced informal feedback and communications from university management. During the interview, it was clear that the respondents did not have any clear or systematic mechanism for measuring the success of a completed and occupied building.

When it comes to the conduct of building performance evaluation, it was clear that the respondents had little or no experience of evaluations. This results from the fact that they associated evaluations with larger enquiries and routine maintenance checks. The respondents often categorised the works they do as follow-up of building performance. They all had experience of working with follow-ups and those frequently conducted were follow-ups on construction works, technical systems and safety issues.

While two of the respondents cited informal interactions regarding user or occupant satisfaction, only one respondent in one of the institutions completed any form of systematic review of occupant satisfaction. Although, the respondents used informal interactions to check what the occupants or users were satisfied or dissatisfied with; this did not result in any form of documentation. However, in recent months or within the period of this interview, none of the respondents had initiated any form of building performance evaluation exercise in all the universities studied.

5.3.2.4 Challenges to the conduct of building performance evaluation

Given the current low level of building performance evaluation practices in the universities under study, the respondents were asked to state the challenges or problems they have in conducting building performance evaluation in the universities**.** The responses were diverse; ranging from cost, time, and professional superiority of designers, lack of trained personnel, political reasons and lack of data. Nevertheless, the consensus of opinion among respondents was that design budgets do not include the cost of building performance evaluation. Almost all the respondents agreed that lack of trained personnel and difficulty in obtaining data on building performance constitute a major challenge to the evaluation of building performance in the institutions. A respondent commented on the problems of conducting building performance evaluation as follows:

> "*We have made efforts to carry out a building performance evaluation exercise in the past but we were frustrated by lack of data. Besides there are no provisions to cover the cost of the building evaluation exercise in my department. What we have in the budget can only cover routine maintenance"*

Only one respondent mentioned that Architects feel superior and proud; and so frown at other professionals reviewing their designs.

5.3.2.5 Incorporating experiences from previous buildings in future building projects.

Because the respondents conduct follow-ups, there was need to know which tools of follow-up they use and how the experiences are fed into existing or new projects. The respondent's responses show that there was neither a system nor any tool to carry out the follow- up. In all cases, it was the estate officer or building officer who carry out routine inspections. This implies that systems for exchange of experience are rare in all the universities.

5.3.2.6 Inclusion of features to improve building operations in the past few years.

Respondents were asked if they had included any features in their buildings in the last few years to improve building performance in institutions. No specific response or description was given for this question. This shows that continuous improvement of building performance is rare in the case organisations.

5.3.2.7 Key indicators of how well a building is performing for users

Respondents were asked to list what they feel are the key indicators of how well a building is performing for users in the institutions. From the point of view of respondents, the key indicators were users' perception of the functional comfort of interior space design. Two respondents mentioned the users' perception of the functional comfort of building systems or indoor environmental quality. These include air quality, noise, and lighting and temperature levels in the indoor environment. Although these were the opinion of respondents based on their experiences, there was no benchmark database for the measurement of the indicators. The only available tool was the standard procedure guide for physical development in Nigerian Universities issued by the National Universities Commission (NUC).

5.3.2.8 Awareness of benchmarks or assessment tools

The common opinion among respondents regarding benchmarks or assessment tools was the absence of any local or national benchmarks for building assessment. Some of the respondents were aware of benchmark data and assessment tools used in such countries as USA and Canada. However, they pointed out that benchmarking of building performance is not yet a common practice among construction professionals in Nigeria. According to one of the respondents;

> "*What appears to be a tailored benchmark is the NUCs standard guide for physical development in Nigerian Universities. However, even that guide only gives standard academic space requirements for accreditation purposes. Apart from that, there is no other benchmark that I know about"*

Benchmarks are for different types of buildings and for a local benchmark, a country needs at least 10 buildings of that type (NBI, 2006). Although a tailored benchmark can be developed by an institution, no effort is currently being made by any of the institutions studied to develop its own benchmark for comparisons among many buildings they owned. The conclusion that can be drawn from this scenario is that the institutions do not have the necessary skills and expertise to conduct a reliable performance evaluation exercise.

Figure 5.10 Researcher (in black T-shirt) listening to one of the interviewees

5.3.2.9 Benchmarks used by the Universities and benefits they provide

There was no specific response to the question related to this issue. Most of the respondents could not state any benefits of using benchmarking in the universities. One of the respondents was of the view that standard guides from the NUC help the universities to improve on the space requirements for classrooms and office spaces. When the respondents were asked to state if benchmarking aspects of building performance could improve building value and user satisfaction; four of the seven respondents said "yes" and three said it could have value. The inability of the respondents to state the numerous benefits of the use of benchmarks could be understood because of the low level of perception and little or no application of benchmarking to building evaluations in the universities under study.

5.3.2.10 User complaints regarding buildings in the Universities

Respondents were asked to mention the most common areas of complaints regarding buildings in the universities**.** From the opinion of respondents, the most common areas of complaints are security and health. Complaints about ventilation, noise and air quality were also received occasionally by the respondents. Respondents further mentioned maintenance issues such as leaking roofs, damaged doors and windows as other areas of complaint. Respondents finally encouraged making suggestions on how to improve the performance of buildings in the universities. Three respondents strongly recommended provision for the cost of building performance evaluations in the departmental budgets of the universities; two recommended increased awareness and training of staff in building performance evaluation skills while the remaining two recommended that professionals should co-operate among themselves in carrying out evaluation exercises rather than the concern for liabilities arising from design and building performance failures.

5.3.2.11 Summary of in-depth interviews

The general conclusion that can be drawn from the interview segment of this study is that respondents rarely measure aspects of a building's physical performance. When they do, it is done in form of informal complaints and communications. Only one of the respondents has what appears to be a systematic way of collecting information regarding occupant or user satisfaction. Respondents generally seemed interested in the concept of building performance or an evaluation tool for measuring the standard performance of buildings. All the respondents agreed that they would use such a tool if available for measuring the performance of buildings in the universities. Cost of evaluation and lack of database in the country were listed as the major obstacles to the building performance evaluation exercise. This was followed by time constraints, pride and protection of professional territories by design professionals.

However, at the end of the qualitative phase of the investigation, those activities which represented "best practices" were incorporated into the questionnaires. The questionnaires form the main quantitative contribution to this thesis; aiming primarily at supporting the qualitative findings described in the preceding sections. The next section presents the analysis and results of the survey questionnaires from the field work.

5.3.3 Analysis and results of research questionnaire Surveys

The research questionnaires were designed using variables from the exploratory studies, constructs freely supplied by the interviewees and the literature survey. The design was intended to obtain representative views of the respondents on the levels of importance or relative impact of each attribute of building performance within a set of attributes being rated. Likert scales were provided on a rating continuum (1-5) to measure the varying degrees of respondents' opinions about the relative worth of the attributes in the subsets. Agresti and Franklin (2007) support the use of Likert scale in measuring opinions, beliefs and attitudes.

5.3.3.1 Profile of respondents

The respondents for questionnaire 1 (**see Appendix 2**) were staff in leading or key positions of the works and physical planning departments of the universities. All the respondents were registered professionals with their various professional bodies in the country and have had a considerable number of years of experience in design, construction and management of buildings. The respondents for questionnaire 2 (**see Appendix 3**) were full time staff of the universities with at least four years of experience; and full time students who have spent at least four years in the universities and also resident in the university residencies. The responses to the questions could therefore be considered as true and accurate reflections of the state of affairs in view of the positions and years of experience of the respondents.

5.3.3.2 Distribution and response to staff and student questionnaires(Questionnaire 2)

A total number of 170 questionnaires were distributed to all the four universities based on a stratified random sampling. Out of this number, 86 questionnaires were completed and returned which corresponds to a response rate of about 51 percent. According to Bryman and Bell (2003), a range of response rates of 30-94 percent in the field of organisational research is acceptable. The rest of the questionnaires were either not properly completed or returned uncompleted. The ones not properly completed were disregarded because they were not usable. No reason was given by the respondents for the uncompleted questionnaires.

Table 5.4 shows the population distribution of the respondents and the percentage response to the questionnaires.

Table 5.4 Population distribution of questionnaires and percentage response for each Institution

Case organisation	Number of questionnaires distributed	Number questionnaires received (response)	Percentage contribution to total response
University A	50	30	35
University B	45	20	23
University C	45	20	23
University D	30	16	19
Total	**170**	**86**	**100**

Table 5.4 shows that the highest proportion of respondents came from university A. This can be explained by the relatively high student and staff population of the university compared to other universities in the study. However, there is no doubt that the differences and apathy observed could have resulted from geographical variations in the opinion of respondents about lack of funding and provision of infrastructural facilities by government. The researcher observed that stakeholders, particularly staff and students show widespread discontent about inadequate building facilities with most complaints coming from university D.

As stated earlier in section 4.9.5, there are two sections of the questionnaires; section A and section B. Section A covers demographic questions while section B covers the main questions. The next section presents the analysis and results of the demographic questions for questionnaire 2 (staff and students)

5.3.3.3 Demographic questions (questionnaire 2)

In section A of this questionnaire, answers to the background questions and an overview of the respondents' characteristics such as gender, status, and experience are presented.

5.3.3.4 Gender of respondents

Responses to this effect are presented and analysed in Table 5.5

Table 5.5 Respondents' gender

Gender	Number	Percentage (%)
Male	55	64
Female	31	36
Total	**86**	**100**

Table 5.5 shows that 64 percent of the respondents were male and 36 percent were female. This is an over-representation of male respondents in the survey which could lead to bias. However, it does reflect the Nigerian university education system which is dominated by male students and staff.

5.3.3.5 Status or occupation of respondents.

The bar chart in Figure 5.11 displays the distribution of the respondents' occupation or status in the universities.

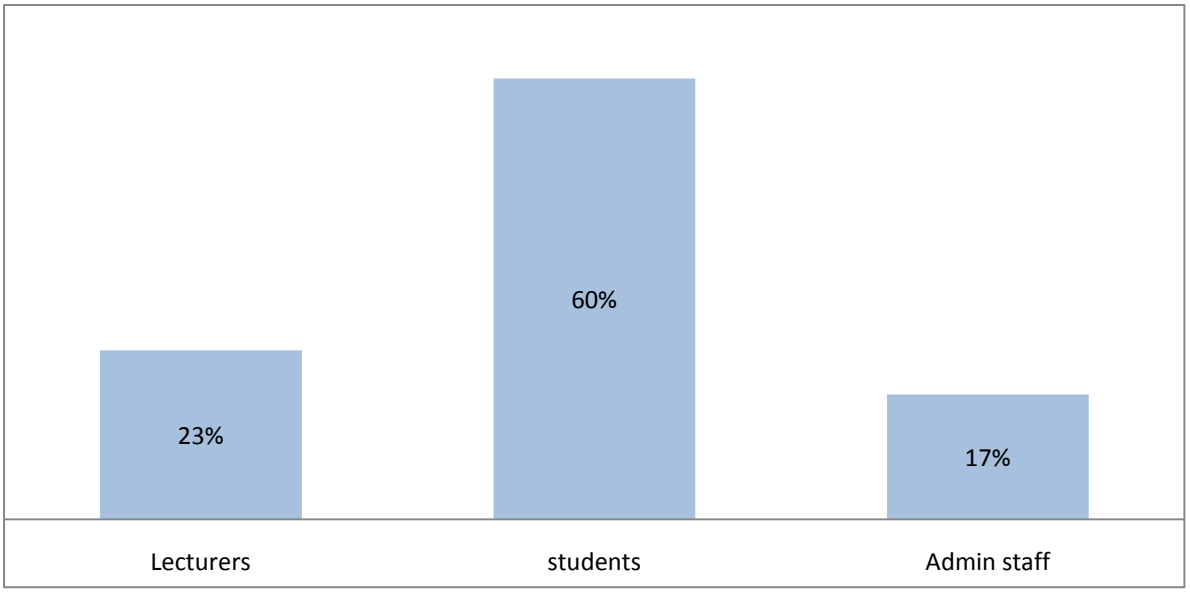

Figure 5.11 Status/occupational distribution of respondents

Figure 5.11 shows that majority of the respondents are students (60 percent). This adequately represents the highest group of users of building spaces in the universities. However, all the staff (both administrative and academic staff) constitutes about 40 percent (23 + 17) of the respondents. This also gives a fair representation of the staff and students proportion in the Nigerian university system.

From these two background questions and the respondents' profiles already described in section 5.3.3.1, a conclusion can be drawn that the respondents are representative in terms of knowledge and experience of building performance in the university system. The next section deals with the main questions.

5.3.3.6 General building performance and environmental concerns

This is a very lengthy section. The aim of the section is to obtain information about the knowledge and experiences of respondents regarding the general performance and environmental quality of educational buildings. The questions were structured to explore the respondents' reactions to the buildings on campus and further reveal insights about the respondents' wellbeing in the universities' environment. The responses to the questions in this section are presented and analysed as follows:

5.3.3.7 Average time spent in building spaces by the respondents

Responses to the question regarding the average time (weekly) the respondents spent in the various building spaces are presented and analysed with the aid of line graphs from Figures 5.12 to 5.18

- **Office spaces**

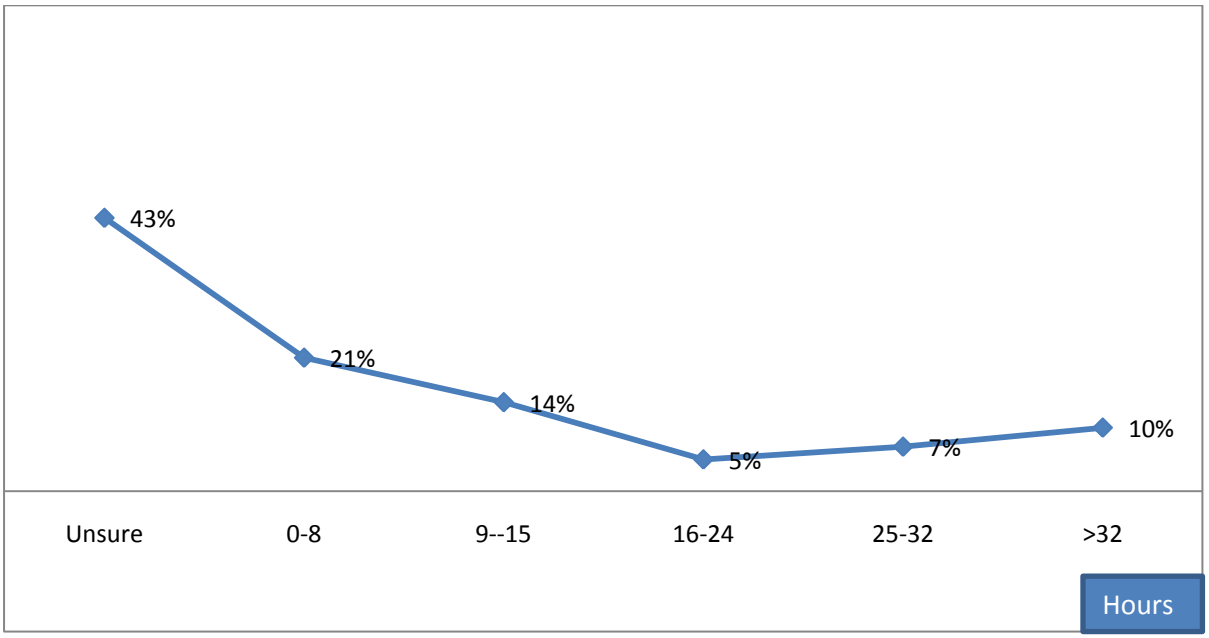

Figure 5.12 Line graph of time (in hours) spent in office spaces by the respondents

Figure 5.12 shows that about 43 percent of the respondents were not sure about the number of hours they spend in their offices on a weekly basis. About 21 percent spend between 0-8 hours; those that spent 9 to 15 hours were about 14 percent and those that spent 16 to 24 hours were 5 percent. Again, the respondents that spent 25 to 32 hours in their offices were about 7 percent and those that spent more than 32 hours in their offices were 10 percent. The

high number of respondents who were not sure of the number of hours they spent in their offices can either be explained by the fact that the staff do not spend quality time in their offices or do not bother about time spent in the offices.

The figure also indicates that a relatively higher percentage (21 percent) of respondents spent between 0 to 8 hours. This is followed by 14 percent (9 to 15 hours) and 10 percent (>32 hours) respectively. The respondents in these categories are mostly staff who use office spaces to perform their duties and if the offices are not conducive, the lecturers may prefer to be more in the classrooms than their offices. The relatively low percentage (5 percent) of respondents who spent more hours in their offices indicates an appreciable loss of productivity in the university system. It also points to the conclusion from the interviews that space efficiency is poor and this might be responsible for high level of absenteeism in the offices.

- **Lecture/ Classroom spaces**

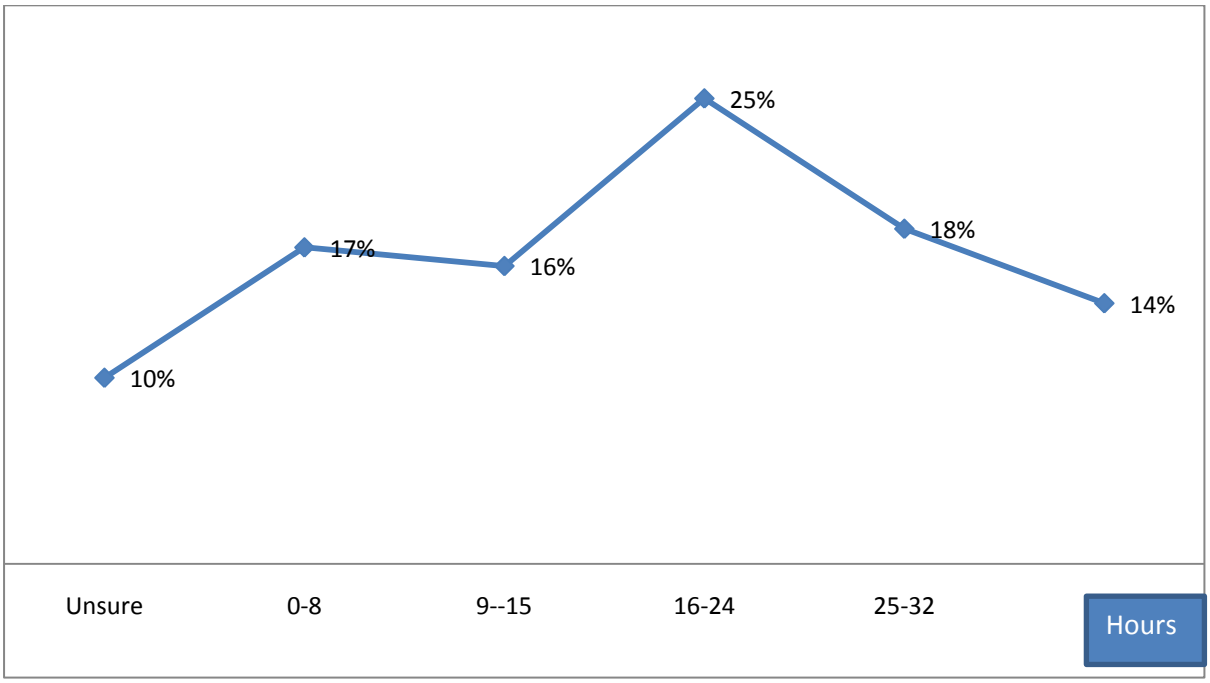

Figure 5.13 Line graph of time (in hours) spent in lecture/classrooms by the respondents

Figure 5.13 shows that again 10 percent of the respondents were unsure of the number of hours they spent in classrooms. 17 percent spent between 0 to 8 hours; 16 percent spent 9 to 15 hours; 25 percent spent 16 to 24 hours; 18 percent spent 25 to 32 hours and 14 percent spent more than 32 hours respectively. In this case, the highest percentage (25 percent) of

respondents spent between 16 to 24 hours in classes in a week. The conclusion can once again be drawn that most of the respondents (25 percent) spent more time in classes than those who do not. This can be understood because classrooms provide spaces for teaching and learning.

- **Laboratory/ Workshop spaces**

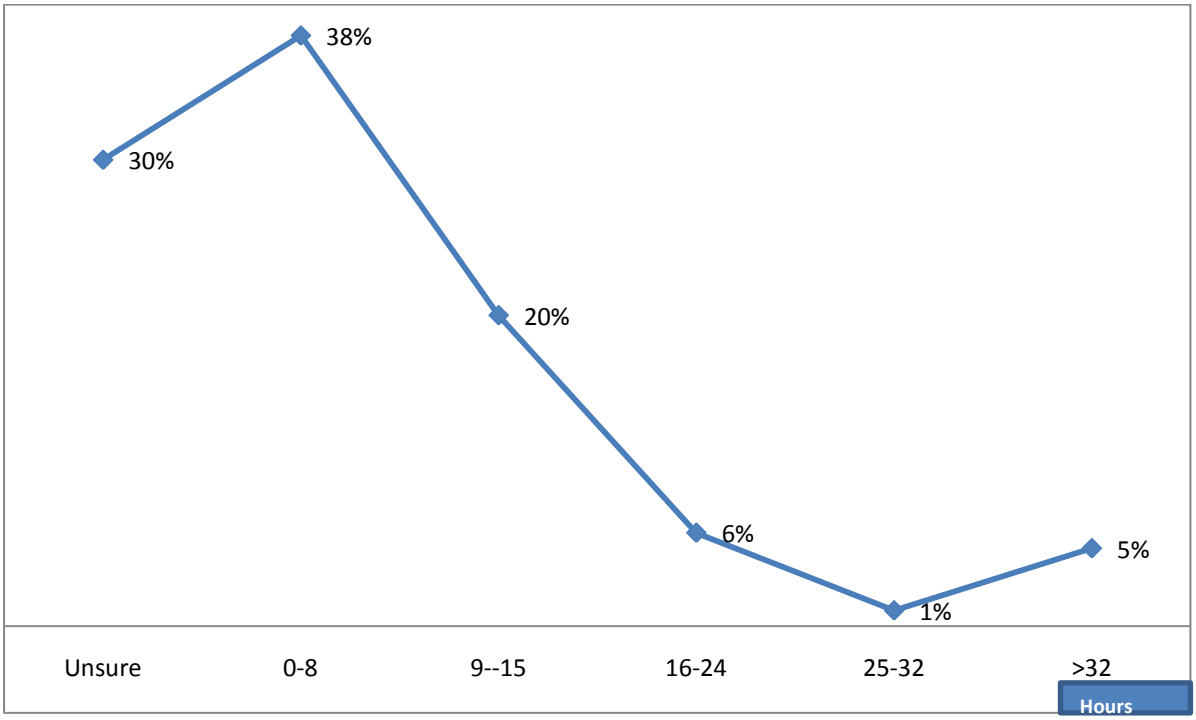

Figure 5.14 Line graph of time (in hours) spent in laboratories and workshops by the respondents

As displayed in figure 5.14, most of the respondents (38 percent) spent little time (0 to 8 hours) in the laboratories. This is a surprise because laboratories include the computer laboratories where staff and students spend most of their time. The explanation to this may be lack of adequate laboratory facilities. Again, the workshops are usually not used on a regular basis and so the respondents are not likely to spend more time in them or may be the 4th year students' syllabi do not include a lot of laboratory work.

❖ **Libraries**

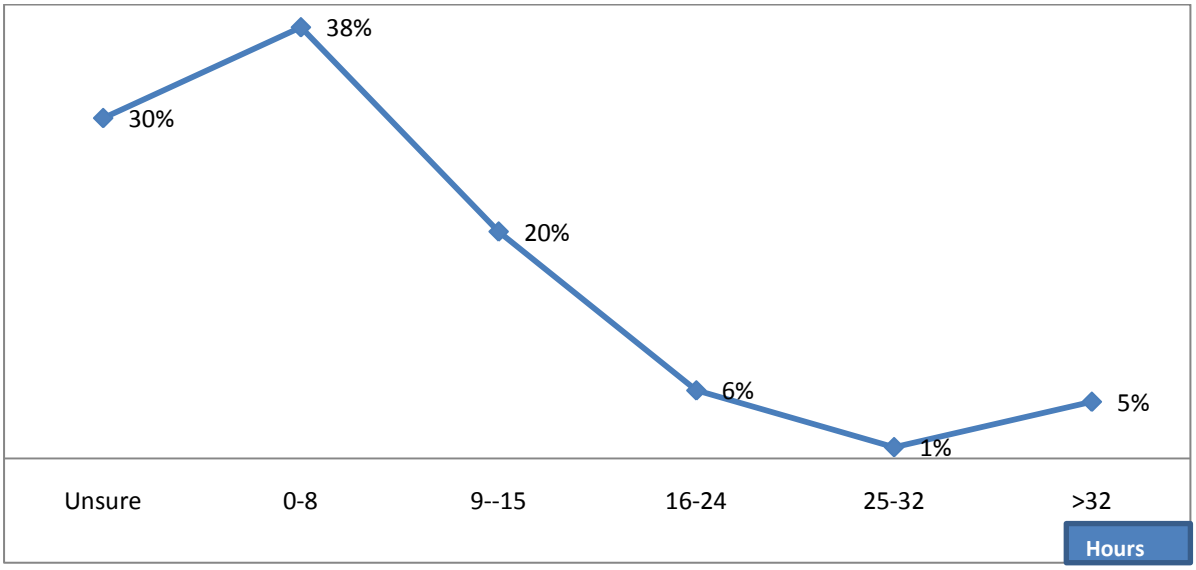

Figure 5.15 Line graph of the time (in hours) spent in the libraries by the respondents.

Again figure 5.15shows that most respondents (37 percent) spent few hours (0 to 8 hours) in the libraries which could seem slightly odd when you think that most people spend more time in the libraries. This indicates a poor reading culture among the respondents in the universities. Only about 3 percent of the respondents spent more than 32 hours per week in the libraries. A library that is not properly designed and equipped cannot be conducive for learning. The under utilization of library facilities by the respondents is an indication of the absence of functional library facilities. This state of affairs does not in any way enhance teaching and learning.

❖ **Hostels/Residences**

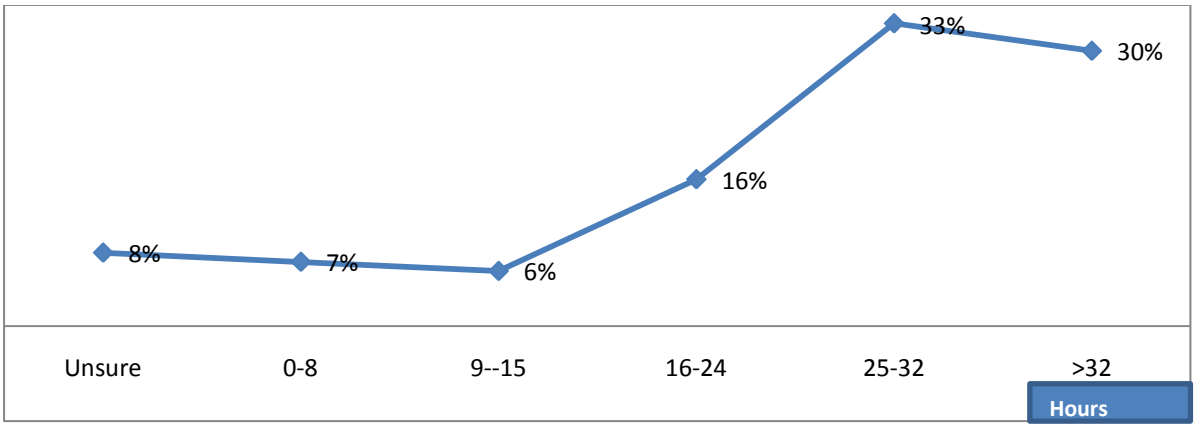

Figure 5.16 Line graph of time (in hours) spent in the hostels/residences by the respondents

Figure 5.16 indicates that most of the respondents (33 percent) spent most of their time (25 to 32 hours) in their hostels/residences. Only about 7 percent of the respondents spent relatively few hours (0 to 8 hours) in the hostels/residences. This reflects the behaviour of users in the universities as observed by the researcher during the field investigation. Most students and staff quickly return to the hostels/residences when there were no lectures or any social engagements on the campus and most times there were none.

- **Spats and Gymnasiums**

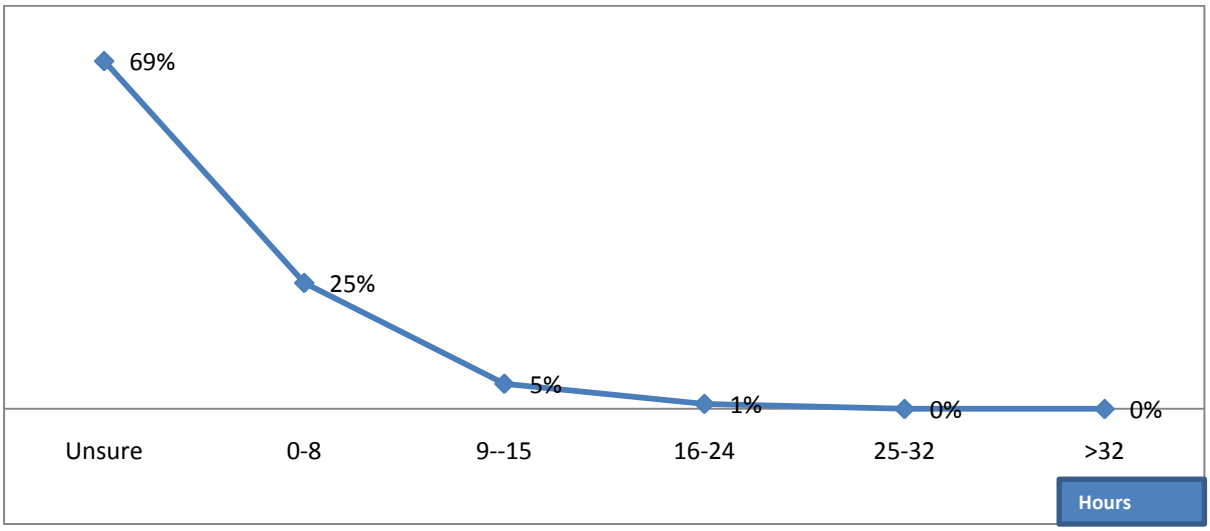

Figure 5.17 Line graph of time (in hours) spent in spats and gymnasiums by the respondents.

Figure 5.17Shows that most respondents (69 percent) were unsure about the time they spent in spats and gymnasiums**.** Only few hours are spent (0 to 8 hours) by about 25 percent of the respondents in these facilities. The rest of the respondents spent little or no time these facilities. Staff and students' need for these facilities are therefore not met. The few hours spent in these facilities by 25 percent of the respondents can be explained by the fact that most of the universities in the study do not have space for such facilities. The inadequate provision of space for spats and gymnasiums shows that the physical well-being of staff and students in the universities are not given enough priority. Physical exercise in an educational environment is very important for effective teaching and learning.

❖ **Auditoriums**

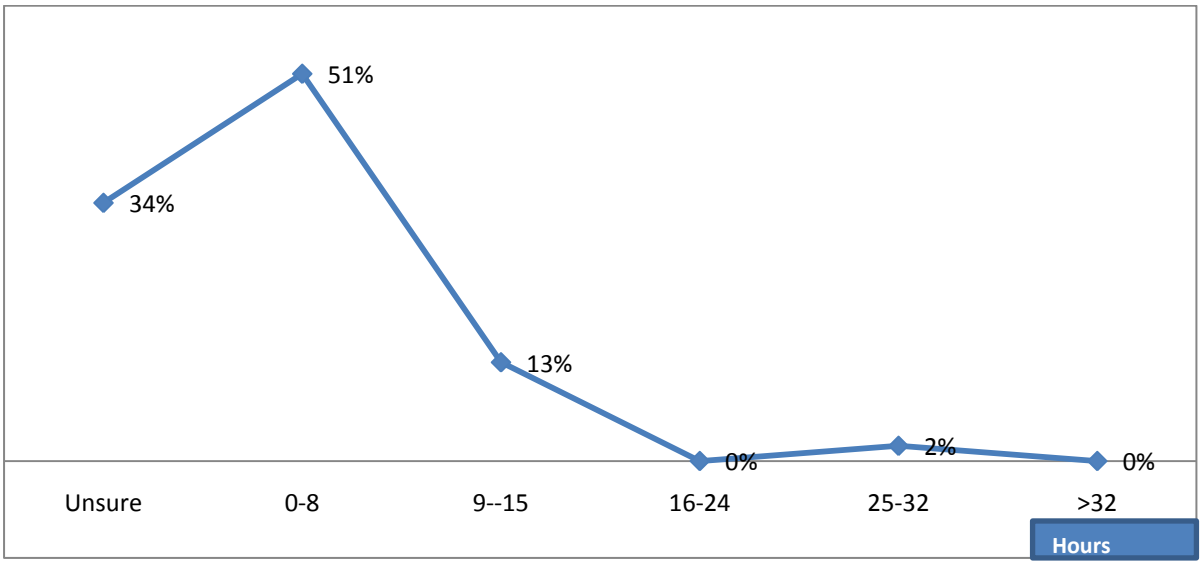

Figure 5.18 Line graph of time (in hours) spent in auditoriums by the respondents.

From figure 5.18, a conclusion can be drawn that more than half (51 percent) of the respondents spent between 0 to 8 hours in auditoriums. Less than half of the respondents share the remaining hours. It can also be observed that a greater percentage (34 percent) of the rest of the respondents were unsure of how much time they spent in auditoriums. The explanations for this are that auditoriums are usually used for large classes and because the respondents were drawn from final year students and staff who seldom use the spaces, the responses may not be a true reflection of the use of these auditoriums. Besides, large classes occur more in lower classes; if the sample size included lower classes (which does not fall into the selection criteria), the situation might have been different.

5.3.3.8 Building spaces and the respondents' learning and working environment

To determine the extent to which the building spaces enhance/make work easy or hinder/make work difficult, the respondents were asked to rate the spaces on a Likert scale (1=more difficult to 5= easier). The scale 3 (unsure) is an undecided or neutral option and in most cases in the subsequent analysis, it was ignored. The responses to the question regarding building spaces are presented and analysed in Table 5.6.

Table 5.6 Rating of building spaces for respondents' studies/work (in percent)

Type of space	More difficult……Easier				
	1	2	3	4	5
	Ratings (in percent)				
Office	14	23	48	8	6
Classrooms	18	24	34	17	7
Lab/Workshops	22	33	21	14	10
Library	20	26	27	17	10
Hostel/Residence	8	7	30	28	27
Spats/Gym	17	19	61	1	2

From the answers displayed in Table 5.6, it can be seen that the respondents felt that it was difficult or more difficult to work or study in laboratories/workshops (33+22=55 percent); libraries (46 percent); classrooms (42 percent) and offices (37 percent) respectively. It was also difficult to work/study in spats/gyms (36 percent). According to the respondents, it was more difficult to work in laboratories/workshops (highest rating of 22 percent) than other spaces. The respondents also believed that it was easy to work or study in hostels/residences and this was also rated highly (55 percent). The respondents' opinion can be explained by the inadequate and poor space efficiency of buildings in the universities under study as will be revealed in subsequent tables.

5.3.3.9 Aspects of the building environment that contribute to safety (in percent)

On a scale of 1(not significant) to 5 (very significant) the respondents were asked to rate how significant some aspects of a building environment contribute to feeling safe. The responses to this question are tabulated and analysed as follows:

The responses shown in table 5.7 indicate that presence of security personnel; both access control and presence of security personnel and lighting make very significant contributions to feeling safe in the building environments.

Although access control to parts of the building was rated highly (48 percent) and considered significant, the highest-rated aspect of the building environment which makes very significant contribution to the respondents' safety was the presence of security personnel in the building.

Table 5.7 Contribution of building aspects to feeling safe by the respondents (in percent)

Aspects of building	Not significant……..Very significant				
	1	2	3	4	5
	Ratings (in percent)				
Access control to building	2	3	19	33	43
Presence of security personnel	1	2	22	23	52
Lighting	3	1	18	31	47
Spatial config/relatively large space	6	16	34	24	20
Access control to parts of building	1	12	25	48	14
Both access control and security personnel presence	1	2	19	28	50

It is notable that spatial configuration or relatively large space was also rated highly and considered significant by the respondents. The conclusion is that all aspects of the building provided in table 5.8 either make significant or very significant contributions to the respondents' feelings of safety.

5.3.3.10 Accessibility to the buildings

The respondents were asked to rate the accessibility of the buildings on a scale of 1 (not accessible) to 5 (very accessible). The responses are presented and analysed in table 5.9.

Table 5.8 Rating of building accessibility by the respondents (in percent).

Aspects of building	Not accessible…….Very accessible				
	1	2	3	4	5
	Ratings (in percent)				
Accessibility into and around the building (lifts, maps, way finding, lighting etc)	**40**	35	14	6	5

In table 5.8, the respondents feel that most of the buildings are not accessible. This means that accessibility into and around the buildings is poor. Accessibility is an important aspect of building performance and buildings that are not accessible to all users cannot be said to be performing well. The implication of the responses in table 5.8 is that people with disabilities or the physically challenged were not considered in the design of the buildings and therefore excluded from effectively using or operating in them. The respondents/users in this regard need more functional and accessible buildings in the university system.

5.3.3.11 Cleanliness of the buildings

Respondents were asked to rate the cleanliness of the buildings on a scale 1 (very dirty) to 5 (very clean) based on the description given. Answers to the question are presented and analysed in Table 5.9

Table 5.9 Cleanliness of the buildings (in percent)

Description	Very dirty……Very clean				
	1	2	3	4	5
	Ratings (in percent)				
How clean is the building?	14	**29**	35	13	9

Table 5.9 shows that most of the buildings were dirty with 29 percent rating. This implies that most of the respondents feel that the buildings are not clean. The table to some extent explains why most of the respondents spent few hours in the buildings as shown in Figure 5.12.

5.3.3.12 Indoor environmental quality of the buildings

This is another lengthy question. The respondents were asked questions relating to the indoor environmental quality. The responses to the question are intended to ascertain whether the buildings are performing to the desired level and address such environmental issues as air quality, temperature, ventilation, room acoustics and lighting. Respondents were required to rate each variable or aspect of the indoor building environment on a Likert scale (1-5) as it affects or applies to them. The responses are again presented and analysed in the following tables:

Table 5.10 Effect of air quality on work performance (in percent)

Aspects of indoor building environment	Not significant……..Very significant				
	1	2	3	4	5
	Ratings (in percent)				
Effect of air quality on your work performance	2	2	9	29	58

Table 5.10 shows that air quality has very significant effect (58 percent) on the work performance of the respondents**.** This is not surprising because the quality of air does affect work performance and well-being of individuals bearing in mind that people spend about 90 percent of their time in closed indoor building environments (Okolie *et al.*, 2009).

5.3.3.13 Air freshness in the buildings

Responses to this effect are presented and analysed in Table 5.11

Table 5.11 Respondents' rating of air freshness in the buildings

Aspects of indoor building environment	Stale……..Fresh				
	1	2	3	4	5
	Ratings (in percent)				
Air freshness	9	28	36	17	10

As displayed in Table 5.11, the respondents' opinion is that air is almost stale in the indoor building environments. It is notable that only about 17 percent of the respondents feel that the indoor air is almost fresh. This suggests that the quality of air in the indoor building environments is compromised and this is not healthy for learning.

5.3.3.14 Building comfort

Respondents were asked to rate the comfortability of the indoor building environments to obtain their reactions to the various aspects of the indoor environment. The responses are presented and analysed in Table 5.12

Table 5.12 Rating of the building comfort by the respondents (in percent)

Aspects of indoor building environment	Uncomfortable……Comfortable				
	1	2	3	4	5
	Ratings (in percent)				
Temperature comfort	36	27	18	14	5
Ventilation comfort	34	30	14	13	9
Discussion privacy and distraction from noise	33	28	29	8	2
Visual privacy	21	27	27	16	9
Artificial lighting comfort	13	12	28	31	16
Natural lighting comfort	8	9	25	37	21

Table 5.12shows that the most uncomfortable aspect of the indoor building environment is temperature (36 percent). This is followed by ventilation (34 percent) and discussion privacy and distraction from noise (33 percent). Most of the respondents view natural lighting to be almost comfortable with the highest rating of 37 percent. According to Sanoff (2003), design for ventilation must support day lighting features but this is not reflected in the above situation. The temperature discomfort can be understood because of the tropical weather in the study area. Artificial lighting was rated highly as almost comfortable (31 percent) while

visual privacy was also rated badly (27 percent) as almost uncomfortable. The general conclusion that can be drawn from Table 5.12 is that none of the aspects of indoor building environment is actually comfortable. This does not encourage effective teaching and learning in the university system.

5.3.3.15 Room acoustics and colour

A question on colour and room acoustics was asked to establish the respondents' assessment of acoustics and choice of colour. The responses are presented and analysed in Table 5.13.

Table 5.13 Assessment of colour and room acoustics by the respondents (in percent)

Aspects of indoor building environment	Poor…….....Very good				
	1	2	3	4	5
	Ratings (in percent)				
Room acoustics	22	23	40	14	1
Colour	17	22	34	22	5

Table 5.13shows that most of the respondents feel that room acoustics is almost poor (23 percent). This means that the sound-carrying ability of the rooms is not acceptable and therefore needs improvement. The respondents' opinion explains why discussion privacy and distraction from noise were rated high and uncomfortable in Table 5.13. Concerning the question on colour, it can be seen from the same table that the respondents' opinion about colour is split between almost poor (22 percent) and good (22 percent). Modern universities must design buildings and create spaces that attract students; similar to the way supermarkets attract customers. One of the physical characteristics of a teaching and learning environment is the use of colour. The best use or choice of colours is dependent on age and gender. The youths which constitute a larger proportion of the university community, admire bright and soft colours, particularly the females (Buys, 2009). It is obvious from the respondents' responses that the building colours in the universities should be made more attractive.

5.3.3.16 Performance measures of the building

The question to this effect was intended to obtain the respondents' views and overall assessment or rating of the performance of buildings in the institutions. The assessment was based on some performance aspects of the building identified in the literature review. The responses obtained from the respondents are presented and analysed in Table 5.14.

Table 5.14 Rating of performance measures by the respondents

Performance aspects of the building	Adequate…….....Inadequate				
	1	2	3	4	5
	Ratings (in percent)				
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

Table 5.14 indicates that all the performance aspects were rated inadequate and almost inadequate by the respondents. It is notable from the table that the most inadequate aspect of building performance is maintenance rated 59 percent. This is followed by fitness for purpose and space needs (58 percent and 40 percent respectively). It must be noted that access to daylight was rated highly (40 percent) and so considered almost inadequate by the respondents. According to the respondents, general accessibility, fire safety, and furnishings were almost inadequate with 37 percent; 33 percent and 23 percent ratings respectively. Most of the respondents' views about sanitary spaces were inadequate. This implies that the performance levels of all building facilities in the universities need to be improved.

5.3.3.17 Satisfaction

The respondents were asked to rate their general level of satisfaction in terms of the overall level of building performance. The responses are presented in Table 5.15

Table 5.15 Overall rating of building performance by the respondents.

Aspect of performance	Dissatisfied……..Satisfied				
	1	2	3	4	5
	Ratings (in percent)				
General satisfaction level	**30**	**42**	12	6	10

Table 5.15 shows that the respondents were almost dissatisfied (42 percent). It can also be seen that a high percentage of the respondents were dissatisfied (30 percent). Only about 10 percent of the respondents were satisfied. The general opinion of the respondents in this table shows that the respondents desire a higher level of user satisfaction from the buildings.

5.3.4 Distribution and responses of designers and service providers' questionnaire (Questionnaire 1)

This questionnaire was designed for service providers and designers drawn from the four universities under investigation. They represent the various professionals engaged by the universities to provide and manage building facilities services over time. The questions were structured so as to obtain information on the current level of building performance evaluation practices; barriers; organisational thinking and attitude towards the evaluation of buildings by the professionals.

It is important to note that this questionnaire was also used to address the hypothetical postulations of this research. A total of 20 respondents were randomly selected (using a table of random numbers) from the list of professionals holding key or leading positions in the works and physical planning departments of the universities. The questionnaires were manually distributed to the respondents and personally collected by the researcher. The distribution of the questionnaires and responses are presented in Table 5.16

Table 5.16 Population distribution of questionnaires for service providers and designers

Case organisation	Number of questionnaires distributed	Number questionnaires received	Percentage response	Percentage contribution to total response
University A	5	5	100	25
University B	5	5	100	25
University C	5	5	100	25
University D	5	5	100	25
Total	**20**	**20**	**100**	**100**

Table 5.16 shows a 100 percent response by the respondents in each of the institutions. This implies that all the questionnaires were properly completed by the respondents and returned to the researcher. No questionnaires went missing.

5.3.4.1 Respondents' gender

The gender of the respondents are presented and analysed as shown in Table 5.17

Table 5.17 Respondents' gender for service providers and designers

Gender	Number	Percentage
Male	18	90
Female	2	20
Total	20	100

Table 5.17 shows that out of 20 respondents, 18 (90 percent) were male and 2 (10 percent) were female. This over-representation of the male gender which could lead to bias is obvious in this table; but it however reflects the picture of the construction industry in Nigeria. The construction sector in Nigeria is dominated by male workers and this scenario plays out in the university system.

5.3.4.2 Profile of building stock in the universities

A question was asked to determine the types of buildings most of the respondents were providing and managing in the institutions. The responses are presented and analysed in Table 5.18

Table 5.18 Types of buildings provided and managed by the case organizations

Case organisations	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							

Table 5.18 shows that most of the buildings provided and managed by the respondents were classroom or lecture buildings. This was followed by office buildings and residential buildings. In the category of special buildings, the researcher found that they also manage such buildings as exhibition halls. This questionnaire is intended to obtain information concerning building and facilities managers, designers and service providers' experiences and attitude towards evaluations in their various organisations. The answers from respondents regarding these special buildings are also relevant. In terms of the percentage distribution of the buildings in Table 5.18, Figure 5.19 shows the distribution of the buildings in percentages according to types.

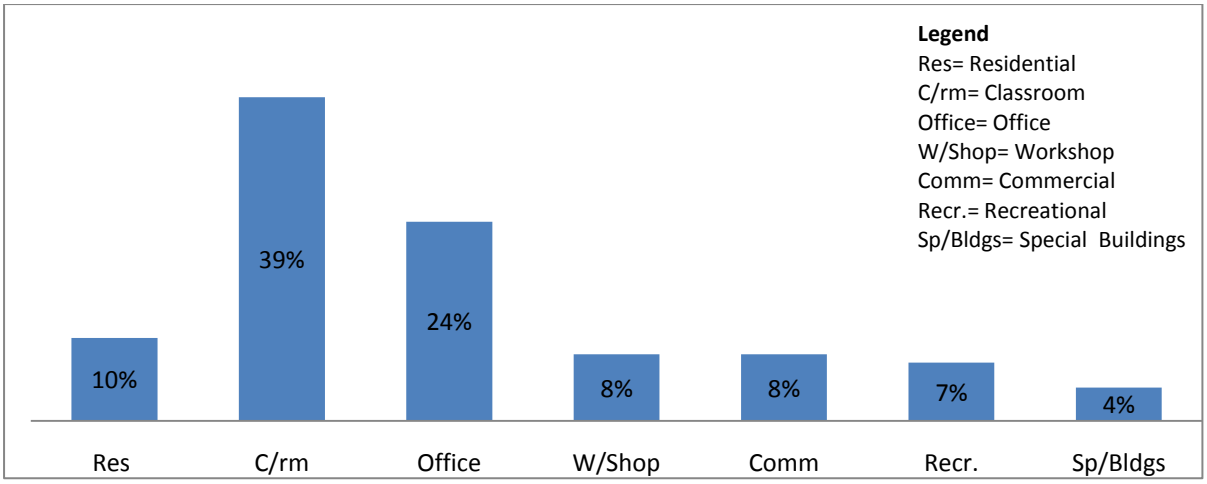

Figure 5.19 Percentage distributions of buildings provided by the institutions

Figure 5.19repeats the information shown in Table 5.18 in terms of percentage distributions It must be noted that the researcher found that the respondents' focus was on providing and managing buildings owned and used by the universities. The buildings were not used for external functions or letting.

5.3.4.3 Involvement in building performance evaluation exercise

To determine the level of involvement of respondents in building performance evaluation exercises, the respondents were asked to state "Yes" or "No" to the question:

"Have *you been involved in a building evaluation?"*

The results of responses and analysis shows that 70 percent answered "No" and 30 percent answered "Yes". Figure 5.20 shows the results of the responses in a pie chart.

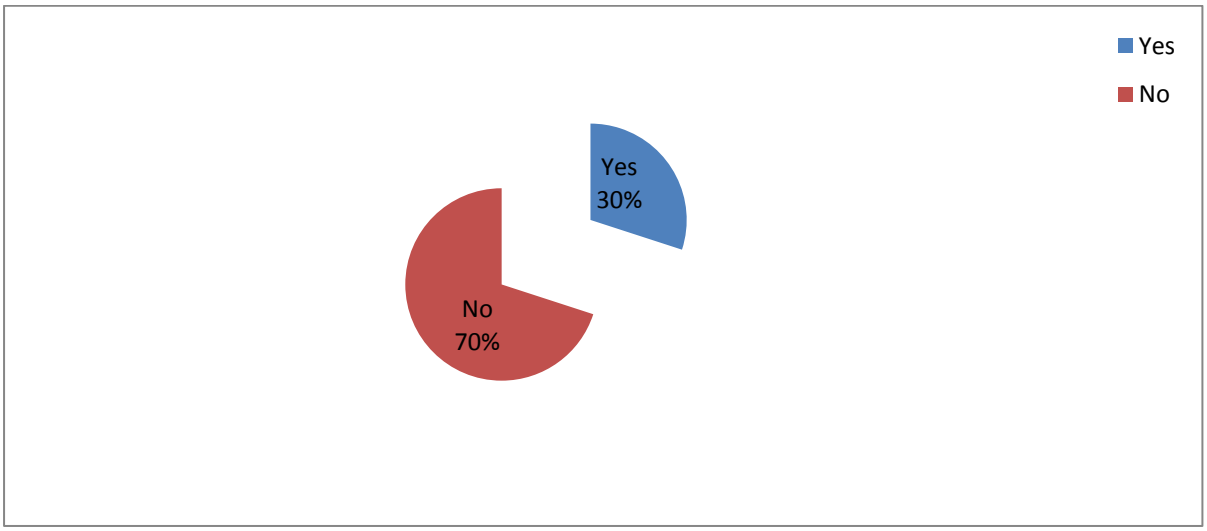

Figure 5.20 Involvement of respondents in building performance evaluation

Figure 5.20 shows that majority of the respondents had no knowledge of evaluation (70 percent) and so were not involved in building evaluations. This shows that most of the respondents were not well informed about evaluations. From the figure, only about (30 percent) of the respondents had knowledge of building evaluations. This again indicates that the institutions lack experienced or skilled personnel to carry out evaluation exercises.

5.3.4.4 General perception and practice of building performance evaluation

The idea of this question was to establish the level of understanding/perception of the respondents concerning building performance evaluation and its implementation in the case organisations. This question was structured to generate responses or data that will help in testing the hypotheses postulated in section 1.5. The hypothetical statements were presented on a Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Respondents were asked to rank the statements according to the extent to which they agree or disagree. This helped to establish the evidence in support or against the categorical statements. Statistical test of proportion was used to test the hypotheses using Excel. Details of the analytical procedure adopted for the analysis and test of significance is presented in the coming sections. The results and analysis of the responses are presented in Table 5.19.

Given the analysis presented in table 5.19, the following deductions can be made:

- The first deduction is that 65 percent of the respondents strongly agreed that lack of effective feedback mechanism results in poor design and procurement of unsuitable buildings. This statement ranks first in agreement with a mean rating of 4.55. While 30 percent of the respondents agreed with the statement, only about 5 percent disagreed. Given that the test statistic (3.20) is greater than the critical value (1.65) at 5 percent level of significance; it can be statistically concluded that a significant proportion of respondents support this statement and that strong evidence also exists in support of the statement.

Table 5.19 Responses on the practice and perception of building performance evaluation (N=20).

Statements	*SD .....SA					M	P	TS	CV	Rank
	1	2	3	4	5					
	Ranking (in percent)									
Emphasis on building performance and user-value enhances design and organisational effectiveness	0	15	10	**60**	**15**	**3.75**	0.750	**1.37**	**1.65**	**8**
Funding of building performance evaluation is below best practice standards	0	0	5	**70**	**25**	**4.20**	0.950	**3.20**	**1.65**	**6**
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**	**7**
Lack of critical performance indicators/mandates in building design impact significantly on user satisfaction	0	5	0	**60**	**35**	**4.25**	0.950	**3.20**	**1.65**	**5**
Inadequate building facilities and spaces for learning and teaching affect academic performance	0	5	5	**45**	**45**	**4.30**	0.900	**2.74**	**1.65**	**4**
Lack of effective feedback mechanism results in poor design and procurement of unsuitable buildings	0	5	0	**30**	**65**	**4.55**	0.950	**3.20**	**1.65**	**1**
Buildings that are not adaptable and flexible do not respond to the demands of changing needs	0	10	0	25	**65**	**4.45**	0.900	**2.74**	**1.65**	**2**
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**	**3**

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

- Again 65 percent of the respondents strongly agreed that buildings that are not adaptable and flexible do not respond to the demands of changing needs. This statement ranks second with a mean rating of 4.45. While 25 percent of the respondents agreed with the statement, only about 10 percent disagreed. Statistically, it can again be concluded that significant evidence exists in support of the statement because the test statistic (2.74) is greater than the critical value (1.65).

- Another deduction is that 60 percent of the respondents strongly agreed and 25 percent of them agreed with the statement that the level of perception and awareness of building performance evaluation is low and impacts significantly on building improvement policies. This ranks third in agreement with a mean rating of 4.35. Only 10 percent of the respondents disagreed with the statement. It can also be statistically deducted that a significant proportion of the respondents support the statement since the test statistic (2.28) is greater than the critical value (1.65)

- Most of the respondents strongly agree or agree (both 45 percent respectively) that inadequate building facilities and spaces for learning and teaching affect academic performance. Their opinions in this respect are equal and therefore ranked fourth with a mean rating of 4.30. The test statistic (2.74) is again greater than the critical value (1.65). Hence, the deduction is that there is a sufficient evidence or significant support from the respondents about the statement.

- Some 60 percent and 35 percent of the respondents agreed or strongly agreed respectively that lack of critical performance indicators/mandates in building design impact significantly on user satisfaction. This statement ranked fifth in agreement with a mean rating of 4.25. The test statistic (3.20) is greater than the critical value (1.65) which means that a significant proportion of the respondents support the statement and there is a strong evidence for this support. Only 5 percent of the respondents disagreed with the statement.

- Some 70 percent and 25 percent of the respondents agreed or strongly agreed respectively that funding of building performance evaluation is below best practice standard. This statement ranks sixth in agreement with a mean rating of 4.20. The test statistic (3.20) is greater than the critical value (1.65) and so the deduction is that a significant proportion of the respondents support the statement and so there is strong evidence from the respondents to support it. None of the respondents disagreed or strongly disagreed with this statement.

- Most of the respondents agreed or strongly agreed (60 percent and 30 percent respectively) that building facilities that are not fit for purpose impact negatively on

teaching and acquisition of key competencies. This statement ranks seventh in agreement with a mean rating of 4.10. The test statistic (2.74) is greater than the critical value (1.65). The deduction is that a significant proportion of respondents support the statement. Only 10 percent of the respondents disagreed with this statement.

- Most of the respondents agreed or strongly agreed (60 percent and 15 percent respectively) with the statement that emphasis on building performance evaluation and user-value enhances design and organizational effectiveness. This statement ranks eight in agreement and the least ranked statement with a mean rating of 3.75.The test statistic (1.37) is less than the critical value (1.65). This shows that there is insufficient evidence of the respondents' support for the statement. Although, about 10 percent of the respondents were not sure of any response, 15 percent of them disagreed with the statement. This means that more respondents disagreed with this statement than any other statement in the set of categorical statements. It must also be noted that no respondent strongly disagreed in all the statements.

5.3.4.5 Creation of an evaluation plan

Respondents were asked to state whether an evaluation plan related to the goals were created before procurement of buildings or award of contracts. Respondents were asked to answer this question by stating "Yes" or "No". The responses and analysis are displayed in Figure 5.21

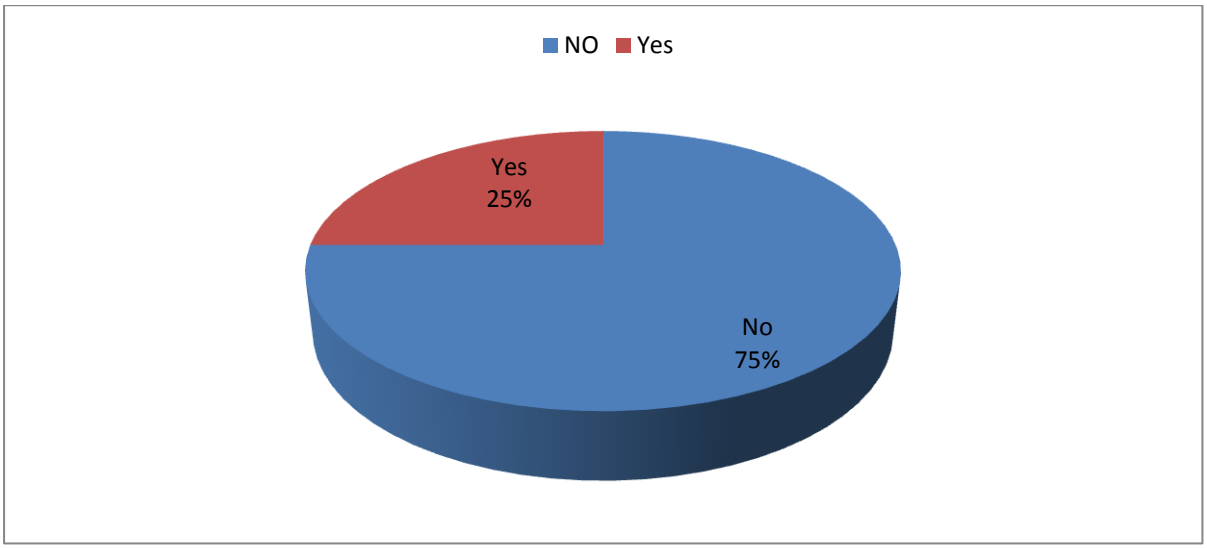

Figure 5.21 Responses on the creation of evaluation plan before procurement by respondents

Figure 5.21 indicates that most of the respondents (75 percent) do not create an evaluation plan before contract procurement**.** Only about25 percent of the respondents create an evaluation plan. With this state of affairs, it may be difficult to conduct any meaningful evaluation exercise that can produce results.

5.3.4.6 Type of building evaluations conducted by the respondents

A question concerning the type of evaluations conducted by the respondents was asked. The results presented in Table 5.20 indicates that the most common type of evaluation conducted by the respondents were inspections (55 percent).

Table 5.20 Building evaluations conducted by the respondents (in percent)

Types of evaluation	Never	Not often	In 50% of cases	Often	Always
Inspections	25	10	5	5	55
External observations	30	25	10	30	5
Interviews with users	40	30	5	20	5
Performance indicators	85	10	5	0	0
Manual measurements	30	20	15	25	10
Personal observations/walkthrough	30	15	10	40	5
Sustainability indicators	70	10	5	10	5

Table 5.20 further shows that the least type of evaluations among the respondents were performance indicators. In 85 percent of cases, performance indicators were never evaluated or conducted. This shows that none of the performance indicators reviewed in the literature was considered by the respondents. Personal observation/walkthrough was highly rated (40 percent) and often conducted by the respondents. This was followed by external observations which was rated 30 percent. The most likely explanation for the strong indication for inspections is the common tradition of technically inspecting buildings by facilities/building managers. In the university system, this is usually done at the beginning of academic sessions when new students/users move in. It is also shown in Table 5.20 that interviews with users were never conducted (40 percent). This indicates absolute lack of interest in user satisfaction.

5.3.4.7 Importance of evaluating buildings

Respondents were asked to rate how important it is to evaluate buildings. The response are again presented and analysed in Figure5.22

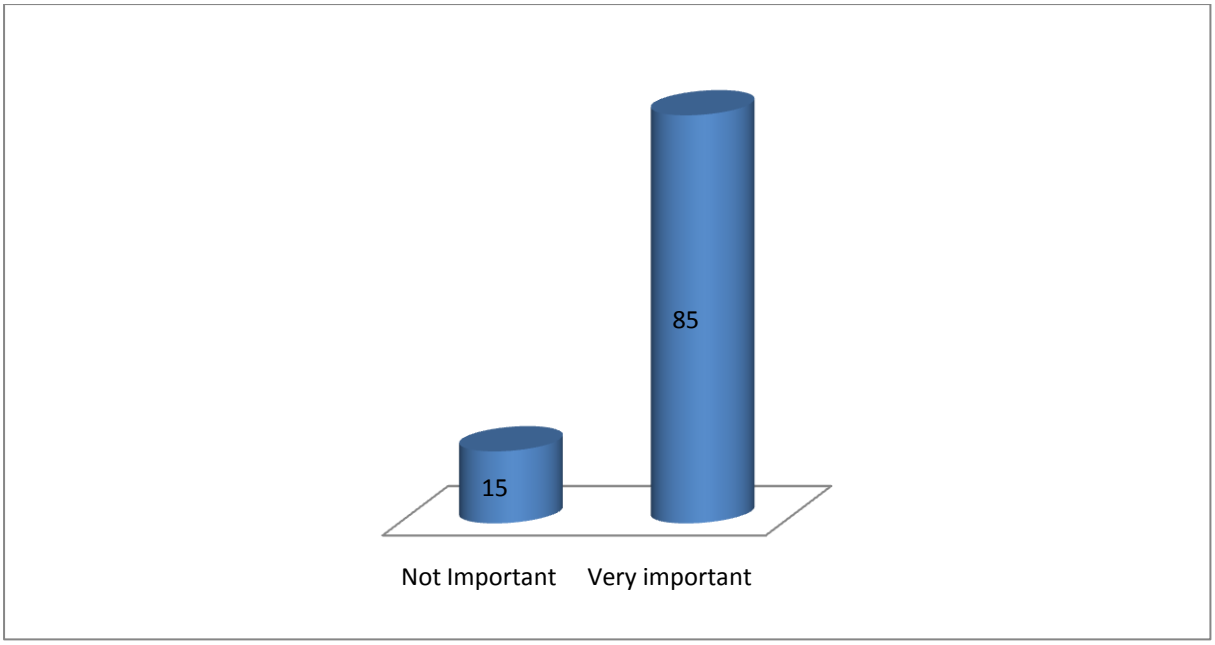

Figure 5.22 Responses on the importance of building performance evaluation

Figure 5.22 shows that 85 percent of the respondents agreed that building performance evaluation is very important**.** Only about 15 percent of the respondents did not feel or agree that it is important to evaluate. When asked which aspect of evaluation their organisations considered more important, the respondents felt it was more important to evaluate both the result and process of evaluation. Figure 5.23 further illustrates the responses by the respondents on what they consider more important to evaluate in their organisations

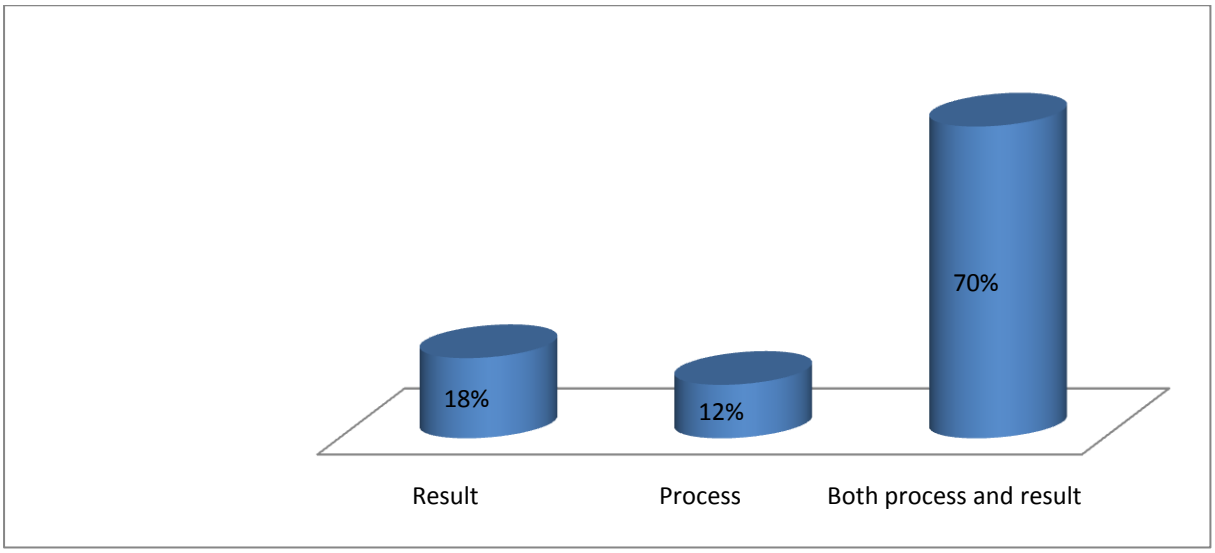

Figure 5.23 Responses on what is more important to evaluate in the organizations.

Figure 5.23, shows that both process and result of building performance evaluation (70 percent) were considered more important than result (18 percent) or process (12 percent) of building performance evaluation respectively. This indicates a strong desire by the respondents for result-oriented performance evaluation exercise in the universities.

5.3.4.8 Techniques/instruments used in evaluating buildings

When asked, "What techniques or evaluation instruments do you use for evaluation of your buildings?" respondents gave the responses presented and analysed in Table 5.21.

Table 5.21 Techniques of evaluation used by the respondents (in percent)

Techniques/instruments	Never	Not often	In 50% of cases	Often	Always
Automatic measurement	80	15	5	0	0
Condition surveys	25	10	10	50	5
Focus group meetings	80	20	0	0	0
Follow-up goals	75	20	5	0	0
Occupant/user satisfaction	45	10	20	10	15
Surveys	60	15	10	10	5

Table 5.21 shows that the instrument often used by the respondents was condition surveys (50 percent). Focus group meetings and follow-up goals (rated 80 percent and 75 percent respectively) were never used. In 45 percent of cases, occupant/user satisfaction was not used and in 60 percent of cases, surveys were not used. This implies that user satisfaction is not given adequate consideration. The fact that the respondents considered the result of evaluation more important than the process (see Figure 5.23) explains why they also do not follow-up goals.

5.3.4.9 Most necessary/critical aspects of the building to evaluate

Respondents were asked to rank on a scale of 1(not important) to 5(very important) eight critical aspects of the building to evaluate in their organisations. The responses are presented and ranked in order of importance in Table 5.22.

Table 5.22 shows the order in which building performance aspects were evaluated in the organisations by the respondents. An important observation in Table 5.22 is that all the aspects were considered important to evaluate by the respondents. It is notable that the highest-ranked factor was functionality.

Table 5.22 Critical aspects of buildings evaluated by the respondents (in percent)

Aspects of building performance	Not important.....Very important					Mean Score	Rank
	1	**2**	**3**	**4**	5		
	Ranking (in percent)						
Functionality	0	20	0	20	**60**	4.40	1
Health and safety	5	5	30	25	35	4.15	2
Cost effectiveness	5	5	25	30	35	4.10	3
Productivity	0	20	0	45	35	3.95	4
Security	5	15	0	**50**	30	3.90	5
Accessibility	5	20	35	35	5	3.80	6
Environmental concerns	5	45	0	35	15	3.80	7
Aesthetics	10	25	0	40	25	3.60	8

This is probably because the respondents think that the best use of evaluation is to improve the functional performance of the building rather than the satisfaction of the users. Functionality was followed by health and safety; and cost effectiveness. The reason for this can be explained to some extent by the newly developed guidelines by the National Universities Commission (NUC) for development of physical facilities in Nigerian universities. It must be noted also that security (personnel) was highly rated.

5.3.4.10 Funding of Building performance evaluation

To ascertain the level of funding, operating costs, processes and staff development, respondents were asked; "Which of the following statements relating to the management and funding of buildings apply to your institutions?" responses obtained from the respondents are presented in Table 5.23.

Table 5.23 Respondents' responses on funding and management of buildings

Statements	Response	Percentage response
Building evaluation and annual management budget are not adequately funded	13	**65**
Operating funds are not spent in a manner that supports desired outcome.	2	10
The right investment is not made in our existing building infrastructure	2	10
Users /occupants of our buildings are generally satisfied with the space and services provided	1	5
Building department/physical planning unit is developing staff that can sustain excellence	2	10
Total	**20**	**100**

Table 5.23 shows that most of the respondents were of the opinion that building evaluation and annual management budget were not adequately funded by the universities. The respondents' opinion in this table supports the views of most participants in the focus group meetings and interviews.

5.3.4.11 Time for conducting evaluations.

Responses given by the respondents on when building evaluations are conducted in the organisations are shown in table 5.24.

Table 5.24 Responses on when evaluations are conducted

Statements	Response	Percentage response
12 months after moving in by occupants/users	1	5
Together with the briefing process	2	10
6 months after moving in by occupants/users	4	**20**
Evaluations are never conducted	4	**20**
Evaluations are conducted while the building is under construction	2	10
2 years and above after moving in by occupants/users	7	**35**
Total	**20**	**100**

The responses given in Table 5.24 shows that most respondents conduct building evaluations after two years of occupation. This was the highest-rated response (35 percent) in the table. Although opinions about when evaluations were conducted appeared to be divided among respondents in the table, many of the responses (20 percent) confirmed that evaluations were never conducted. This makes it difficult to interpret other responses given. Many of the respondents (20 percent) also confirmed that evaluations were conducted six months after users/occupants had moved in. To conduct evaluations earlier than 12 months after moving in by occupants is relatively unusual but even more unusual is the idea of conducting evaluations after two years of moving in by users/occupants. This confirms the conclusion from Table 5.21 that user-satisfaction is not given adequate consideration by the respondents.

From the tables and figures earlier presented, it can be seen that the respondents and in fact the construction professionals find several factors important to evaluate but generally, they seldom or rarely conduct evaluations except technical inspections and informal condition surveys.

5.3.4.12 Reasons for not conducting evaluations

On a scale of 1(strongly agree) to 5(strongly disagree), respondents were asked to rank a set of statements/reasons for not conducting building performance evaluation by the respondents. The responses are presented and analysed in Table 5.25

Table 5.25 Reasons for not conducting evaluations by the respondents

Reasons	Strongly disagree.....Strongly agree					Mean Score	Rank
	1	**2**	**3**	**4**	**5**		
	Ranking (in percent)						
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

Table 5.25 indicates that insufficient expertise was the highest ranked reason (85 percent) for not conducting the performance evaluation of buildings**.** The least reason given by the respondents for not conducting evaluations was sensitive information. The respondents strongly agreed that unwillingness to undertake evaluations and lack of demand (55 percent) were 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. Another reason for this may be that management do not require the employees (respondents) to carry out building performance evaluations as a routine function.

It can be seen from the table that most of the respondents agreed that lack of responsibility and unwillingness to pay for evaluations (50 percent and 45 percent respectively) were also responsible for lack of building performance evaluations. 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. It is

interesting to note from Table 5.25 that half of the respondents (50 percent) did not find evaluation methods too difficult. Perhaps, most of the respondents in this group could come from the few that have been involved in building evaluations as shown in Figure 5.20.

5.3.4.13 Benefits of Building Performance evaluation

Respondents were asked to rank on a scale of 1(not important) to 5(very important) the benefits of building performance evaluation in the organisations. The responses and analysis are presented in Table 5.26

Table 5.26 Responses on benefits of building performance evaluation by respondents

Benefits	Not important…….Very important				
	1	2	3	4	5
	Ratings (in percent)				
Increased productivity	0	0	30	25	45
Feedback to design and construction process	0	0	25	5	70
Improved quality and efficiency at work	0	0	25	25	50
Improved financial result	**10**	5	25	25	35
Improved functional programme	0	0	25	5	70
Continuous improvement	0	0	25	25	50
Satisfied user	0	10	20	30	40

In Table 5.26, a clear focus is displayed by the respondents concerning the benefits of evaluation. Improved functional programme was rated as high (70 percent) as feedback to design and construction process (70 percent). It is clear that respondents believe that these two benefits are very important to improve construction projects in the organisation and not for the users' satisfaction. This explains why satisfied user was ranked fourth (40 percent) among the very important benefits. It must also be noted that most of the respondents did not think that improved financial result was important and so was rated (35 percent) the least important. This again supports one of the barriers to building evaluations given by the respondents (see Table 5.25) that no one is willing to pay for evaluations (ranked 3).

5.4 Test of hypotheses

A hypothesis is an idea or proposition that can be tested for association or causality by deducing logical consequences which can be tested against empirical evidence (Collis and Hussey, 2003:10). Simply put, a hypothesis is a proposition that is empirically testable.

In carrying out a descriptive analysis, it is important to go beyond the simple tabulation of frequencies and calculation of means to find some sort of criterion for answering questions about the differences between what we expected to find (as reflected in the hypotheses) and the actual results of the research. This is to ensure that the conclusions or inferences drawn from the results are reliable. The hypotheses in this thesis were postulated to shed light on the key areas of the research from which data were obtained and analysed with a view to providing answers to the research problems. For purposes of clarity, the research hypotheses are re-stated in section 5.4.1

5.4.1 The research hypotheses

i. Emphasis on building performance and user-value enhances design and organizational effectiveness in educational institutions;
ii. The approach to funding of building performance evaluation is below best practice standards in educational institutions;
iii. Building facilities that are not fit for purpose impact negatively on teaching and acquisition of key competences in educational institutions;
iv. Building facilities which lack critical performance indicators/mandates in their design impact significantly on user satisfaction in educational institutions;
v. Inadequate building facilities and spaces for learning and teaching affect academic performance in educational institutions;
vi. The lack of effective feedback mechanism results in poor design and procurement of unsuitable buildings in educational institutions;
vii. Buildings that are not adaptable and flexible do not respond to the demands of changing needs in educational institutions; and
viii. The level of perception and awareness of building performance evaluation is low and impacts significantly on building improvement policies in educational institutions.

The analytical procedures for testing the above hypotheses are discussed in the next section.

5.4.2 Analytical procedures adopted

Analysis of data was done by entering the data into computer database software packages (Excel spreadsheet and statistica; Version 9.0) and printing of reports to provide the required information. These packages provided easy manipulation and calculation of descriptive data and inferential statistics for testing the hypotheses. 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 (2007:372) that test of proportions can be used for categorical variables (correct and incorrect predictions).

In this regard, the parameters of interest are the population proportions in the categories. The test of proportions was therefore used to determine whether there is any statistical significance in the proportions between the respondents' responses and the hypothetical statements. One of the assumptions underlying significance test of proportions according to Agresti and Franklin (2007:373) is that the sample size must be sufficiently large; such that the distribution of the sample proportion **P** is approximately normal. The condition for normality happens when the expected number of successes and failures are both at least 15, at the null hypothesis value for **P.** In this case, the sample size n = 20 and the null hypothesised value Po = 0.6. This gives 12 (20 x 0.6) which is close to the condition. Although this value is less than normality, it is considered adequate for the test due to the exploratory nature of this research. Besides, one sided tests with small samples are not common in practice (Agresti and Franklin, 2007:385). Hence, the null hypothesis (Ho) of a test of proportion has the form:
Ho: P = Po. Where Ho is the null hypothesis; P is the sample proportion and Po is the particular hypothesised proportion value between **0** and **1.** That is; P ~ N (0, 1).

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

Again P = sample proportion; Po = null hypothesised proportion value and n = sample size.
The test statistic measures how far the sample proportion (P) falls from the null hypothesis value (Po) relative to what would be expected if Ho were true.

In testing these hypotheses, the results of the empirical investigation presented and analysed in Table 5.19 using excel and statistica version 9.0 software packages will be used. For this purpose and for ease of reference, Table 5.19 is hereby reproduced

Table 5.19 Respondents' perception and practice of building performance evaluation

Hypothetical Statements	*SD .....SA					M	P	TS	CV	Rank
	1	2	3	4	5					
	Rank (in percent)									
Emphasis on building performance and user-value enhances design and organisational effectiveness	0	15	10	**60**	**15**	**3.75**	0.750	**1.37**	**1.65**	**8**
Funding of building performance evaluation is below best practice standards	0	0	5	**70**	**25**	**4.20**	0.950	**3.20**	**1.65**	**6**
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**	**7**
Lack of critical performance indicators/mandates in building design impact significantly on user satisfaction	0	5	0	**60**	**35**	**4.25**	0.950	**3.20**	**1.65**	**5**
Inadequate building facilities and spaces for learning and teaching affect academic performance	0	5	5	**45**	**45**	**4.30**	0.900	**2.74**	**1.65**	**4**
Lack of effective feedback mechanism results in poor design and procurement of unsuitable buildings	0	5	0	**30**	**65**	**4.55**	0.950	**3.20**	**1.65**	**1**
Buildings that are not adaptable and flexible do not respond to the demands of changing needs	0	10	0	**25**	**65**	**4.45**	0.900	**2.74**	**1.65**	**2**
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**	**3**

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

From Table 5.19, the tests and results of the hypotheses are presented in the coming sections.

5.4.3 Hypothesis 1:

The null and alternative hypothesis (Ho and H_1 respectively) for the first hypothesis is stated as follows:

- Ho: emphasis on building performance and user-value do not enhance design and organizational effectiveness in educational institutions

- H_1: emphasis on building performance and user-value enhances design and organizational effectiveness in educational institutions

Decision Rule: Reject Ho if $Z \geq Z_1\text{-}\alpha$. Where Z=the test statistic, α. = 0.05 (at 5 percent level of significance) and $Z_1\text{-}\alpha$ = the critical value. But in this analysis, $Z_1\text{-}\alpha$ 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 percent as earlier stated.

Therefore the above hypothesis can be re-stated as:

Ho: $P \leq 0.6$

H_1: $P > 0.6$

This is a one tail or one sided test. Using the Excel software package for the calculations, the test statistic yielded Z = 1.37 (see Table 5.19)

Decision/conclusion: Since Z = 1.37 is not greater than 1.65, the evidence here is statistically insignificant and so the null hypothesis is not rejected. That is; emphasis on building performance and user-value do not enhance design and organizational effectiveness in educational institutions. Ordinarily, one would expect that emphases on performance evaluation and user-value will enhance design and organisational effectiveness. However, the test proved that this hypothesis has no statistical significance and so ranked the lowest in Table 5.20.

5.4.4 Hypothesis 2

The null and alternative hypothesis for the second hypothesis is given as follows:

- H_0: The approach to funding of building performance evaluation is not below best practice standards in educational institutions
- H_1: The approach to funding of building performance evaluation is below best practice standards in educational institutions

This can be re-stated as;

Ho: $P \geq 0.6$

H_1: $P < 0.6$

This is a one sided test and using the Excel software package for the calculations, the test statistic yielded Z = 3.20 (see Table 5.19).

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.

5.4.5 Hypothesis 3

The null and alternative hypothesis for the third hypothesis is given as:

- H_0: Building facilities that are not fit for purpose do not impact negatively on teaching and acquisition of key competences in educational institutions.

- H_1: Building facilities that are not fit for purpose impact negatively on teaching and acquisition of key competences in educational institutions.

Re-stating the above statements of hypothesis, we have

Ho: $P \leq 0.6$

H_1: $P > 0.6$

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 5.19).

Decision Rule: Reject H_0 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.

5.4.6 Hypothesis 4

The null and alternative hypothesis or claims for the fourth hypothesis is given as:

- H_0**:** Building facilities which lack critical performance indicators/mandates in their design do not impact significantly on user satisfaction in educational institutions

- H_1**:** Building facilities which lack critical performance indicators/mandates in their design impact significantly on user satisfaction in educational institutions

This means that:

Ho: $P \leq 0.6$

H_1: $P > 0.6$

The test statistic calculated from Excel software package gave the result as Z = 3.20 (see Table 5.19).

Decision Rule: Reject H_0 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 is statistically significant and so the null hypothesis is rejected and in favour of the alternative hypothesis. This implies that building facilities which lack critical performance indicators/mandates in their design impact significantly on user satisfaction in educational institutions.

5.4.7 Hypothesis 5

The null and alternative claims or hypothesis for the fifth hypothesis is given as:

- H_0: Inadequate building facilities and spaces for learning and teaching do not affect academic performance in educational institutions.

- H_1: Inadequate building facilities and spaces for learning and teaching affect academic performance in educational institutions.

That is;

H_0: $P \leq 0.6$

H_1: $P > 0.6$

The test statistic is given as Z=2.74 (see Table 5.19).

Decision Rule: Reject H_0 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. That is; inadequate building facilities and spaces for learning and teaching affect academic performance in educational institutions.

5.4.8 Hypothesis 6

The null and alternative hypothesis or claims for the sixth hypothesis is given as:

- H_0: The lack of effective feedback mechanism does not result in poor design and procurement of unsuitable buildings in educational institutions

- H_1: The lack of effective feedback mechanism results in poor design and procurement of unsuitable buildings in educational institutions

These statements imply that;

H_0: $P \leq 0.6$

H_1: $P > 0.6$

The test statistic is given as Z=3.20 (see Table 5.19).

Decision Rule: Reject H_0 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 is statistically significant and so the null hypothesis is rejected and in favour of the alternative hypothesis. That is; lack of effective feedback mechanism results in poor design and procurement of unsuitable buildings in educational institutions. This hypothesis was ranked first in Table 5.19 indicating the weight attached to this particular claim by the respondents.

5.4.9 Hypothesis 7

The null and alternative claims or hypothesis for the seventh hypothesis is given as;

- H_0: Buildings that are not adaptable and flexible respond to the demands of changing needs in educational institutions.

- H_1: Buildings that are not adaptable and flexible do not respond to the demands of changing needs in educational institutions.

Re-stating the above statements, we have

H_0: $P \leq 0.6$
H_1: $P > 0.6$

The test statistic is given as Z=2.74 (see Table 5.19).
Decision Rule: Reject H_0 if $Z \geq 1.65$ (the critical value) at 5 percent level of significance

Conclusion: Since Z = 2.74 is greater than 1.65, indicating that the evidence is statistically significant and so the null hypothesis is rejected and in favour of the alternative hypothesis. That is; buildings that are not adaptable and flexible do not respond to the demands of changing needs in educational institutions. This claim ranked second in Table 5.19.

5.4.10 Hypothesis 8

The null and alternative hypothesis or claims for the fourth hypothesis is given as;

- H_0: The level of perception and awareness of building performance evaluation is high and does not impact significantly on building improvement policies in educational institutions.

- H_1: The level of perception and awareness of building performance evaluation is low and impacts significantly on building improvement policies in educational institutions.

This implies:
H_0: $P \leq 0.6$
H_1: $P > 0.6$
The test statistic is given as Z=2.28 (see Table 5.19).

Decision Rule: Reject H_0 if $Z \geq 1.65$ (the critical value) at 5 percent level of significance.

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.

The above results show that all but one of the hypothetical statements was supported. All the hypotheses in this study were developed and tested with data obtained from all the case organisations. This was done because there were no significant contextual differences in the study setting. The next section presents the walkthrough evaluations and direct measurements conducted in the institutions.

5.5 Walkthrough, observations and direct measurements

Walkthrough evaluations and direct measurements were undertaken in all the case organisations by the researcher. This was based on the criteria set by the National Universities Commission (NUC) for the procurement of physical facilities in Nigerian Universities. The objective of the standard guide is to optimise the use of resources in terms of capital and technical expertise consistent with national need in the area of education (NUC, 2004). The guide sets general standards in the areas of University environment, design, materials, construction, services, space standards, cost limits, furniture and equipment. It covers all the important aspects of building design and further provides the framework for drawing up project briefs. The briefs must be used by the consultants and staff of physical planning in all the universities in Nigeria. The walkthrough evaluation and measurements covered in this study include the design and space requirements of buildings captured in the focus group discussion and questionnaires.

The researcher carried out a simple random sampling of 87 buildings representing about 37percent of the total building stock (237) owned and managed by the institutions as shown in Table 5.18. The buildings were evaluated as designed and built. The categories of spaces measured include:

- Departmental areas;
- Lecture theatres and classrooms;
- Communal, social and service buildings; and
- Residential buildings.

The measured spaces were compared with the minimum standards provided by the NUC guide to determine the extent of compliance. The results and analysis of data are presented in section 5.5.1

5.5.1 Departmental Areas

Data were obtained from the spaces as presented in Table 5.27

Table 5.27 Spaces observed and measured in departmental areas of target universities.

Description of spaces	Minimum Standards (m^2)	Average Area Measured (m^2)	Shortfall	Remarks
Professors' offices	25	18	7	Inadequate
Heads of departments	25	17	8	„
Teaching staff offices	16	12	4	„
Other teaching staff offices	12	10	2	„
Technical staff offices	12	10	2	„
Secretarial spaces	12	8	4	„
Science staff research laboratories	16.5	12	4.5	„
Engineering staff /research laboratories	16.5	12	4.5	„
Seminar spaces	1.85	1.2	0.65	„
Drawing office space s(A1) Board	4.60	4.0	0.60	„
Drawing office spaces (A0) Board	3.70	3.0	0.70	„
Laboratory spaces	7.50	8	0.00	Adequate

5.5.2 Lecture theatres and classrooms

Lecture theatres and classrooms used centrally were measured and compared with the minimum figures in the guide based on a sliding scale of user space**.** Table 5.28 presents the data obtained from lecture theatres and classrooms.

Table 5.28 Spaces observed and measured in lecture theatres and classrooms

Description of spaces	Minimum standards (m^2)	Average Area Measured (m^2)	Shortfall	Remarks
Up to 30 seats	1.20	0.75	0.45	Inadequate
30 – 60 seats	1.00	0.50	0.50	„
60–125 seat	0.9	0.45	0.45	„
125–250 seats	0.8	0.30	0.50	„
Over 250 seats	0.75	0.25	0.50	„

5.5.3 Communal, Social and Service buildings

Usable areas for the following spaces were also measured and compared as presented in the following table**.** The spaces are based on student capacity of 667 as provided by the standard guide.

Table 5.29 Spaces observed and measured in communal, social and service buildings

Description of spaces	Minimum standards (m^2)	Average Area Measured (m^2)	Shortfall	Remarks
Television/common room; quiet lounge, and library	186	95	91	Inadequate
Bar/snacks	50	40	10	„
Games room	145	75	70	„
Kiosk	10	10	00	Adequate
Dining	1.10	Nil	1.0	Not available

5.5.4 Residential buildings

Residential accommodation for staff were not available in all the universities studied. The measurements described in Table 5.30 refer to students' residential accommodation. The NUC minimum standard assumes that $33^1/3$ percent of the students' population will be accommodated on campus and that the ultimate population of 10,000 students applies. Table 5.30 presents the data as observed and measured in the study.

Table 5.30 Spaces observed and measured in residential buildings or accommodations

Description of spaces	**Minimum standards (m^2)**	**Average Area Measured (m^2)**	**Shortfall**	**Remarks**
10% enrolment in rooms for two students	15	6	9	Inadequate
$23^1/3$% enrolment in rooms for four students	24	16	9	„
Students (per bed space average)	10.2	5	5.2	„

5.6 Discussion and interpretation of Key issues in the study

The following major issues arising from the findings of the surveys are discussed as follows**:**

5.6.1 Hypotheses

All the research hypotheses listed in section 5.4.1 were postulated based on the research problem and sub problems. The hypotheses were related to eight measurable characteristics of building performance evaluation practices identified in the literature review. These measurable aspects (qualitative and quantitative) of building performance are consistent with

findings on the evaluation of building performance (Preiser, 2002; Leaman, 2003; Sanoff, 2003; OECD, 2006; Palm, 2007). These performance measures relate to space, accessibility, maintenance, security, fitness for purpose, adaptability and flexibility, funding/cost effectiveness, user satisfaction/comfort, productivity, aesthetics, health and safety. These variables were discussed in section 2.5 and categorised in section 3.4.9 as functional; physical/behavioural; service/psychological; economic/financial and environmental indicators of building performance (Then and Tan, 2002). This study captured these identified variables in the quantitative and qualitative investigations. The analysis and results of the qualitative data (focus group and in-depth interviews) shows that majority of the users/respondents (both staff and students) were generally dissatisfied with the functional performance of their building facilities. The findings summarised in Tables 5.14 and 5.15; and Figures 5.12 to 5.18 point to this conclusion. Again both staff and students share the same opinion on the behavioural and financial performance of their buildings.

The results of the hypotheses tests indicate that a statistically significant proportion of respondents support the claims in seven hypothetical statements but did not do so in only one statement which to some extent may be explained by the sample size. This shows that the only variable that may not significantly enhance design and organizational effectiveness in educational institutions is emphasis on building performance and user-value (hypothesis 1). However, the focus group study did not support this view. Results of the interview and focus group meetings suggested rather that emphasis on building performance and user-value actually enhances design and organisational effectiveness. This can be explained by the respondents' comments on the shortcomings of building designs in the institutions which they felt did not encourage effective teaching and learning. These shortcomings were outlined in section 5.3.1.1 as:

- Inadequate and improper co-ordination of spaces;
- Poor finishes;
- Poor landscaping; and
- Insufficient parking lots.

These design shortcomings would have been avoided if proper performance evaluation of the buildings in terms of user-value or needs were emphasised during the design process. This requires a holistic and proactive approach to the design and facilities management functions

which improves efficiency in an organisation. Although the evidence in support of this hypothesis (hypothesis 1) is statistically insignificant, the percentage margin in the proportion is not wide (about 15 percent). As stated earlier, this may be explained by the distribution of the sample. Nevertheless, the apparent lack of awareness and poor perception of building performance evaluation as an effective tool for value improvement in an organisation further explains why hypothesis 1 was not supported. The wider implication of the findings associated with hypothesis 1 is that policy makers and construction management professionals must lay emphasis on building performance evaluation and user-value when developing a built asset/facilities management strategy and policy framework both in the university system and the construction industry as a whole. Against this backdrop, when developing a building performance evaluation framework or model which the institutions may use to evaluate the performance of buildings, this variable must be considered.

From the foregoing, all the problems identified in this study have been addressed by findings from the field studies and empirically validated by the hypotheses testing. The next section presents further discussions of the summary of findings.

5.6.2 Focus group discussions; in-depth interviews and questionnaires

Comments, quotations and opinions from staff and students were used in the above instruments to highlight the opinions, experiences and feelings of participants about the performance of buildings and evaluation practices in the universities under investigation. Generally, the participants' experiences and feelings show that interaction between them and building facilities in the universities do not add value to their learning and working experiences. The participants' comments and responses indicate concerns regarding the following building performance evaluation issues:

- Poor space conditions and management;
- Uncomfortable noise levels and lack of privacy;
- Poor environmental quality in terms of comfort;
- Lack of stakeholders' (users) involvement in the design of educational buildings;
- Lack of convertibility and versatility of use (adaptability and flexibility);
- Poor safety, health and security conditions in the buildings; and
- Lack of a clear or systematic mechanism for measuring the success of completed and occupied buildings.

The major challenges identified by the respondents in the study include:

- Lack of funding
- Lack of skilled personnel;
- Lack of performance evaluation database and standards;
- Time and ethical constraints; and
- Protection of professional territories by design professionals

The above concerns and challenges have been discussed in sections 5.3.1 and5.3.3 including their sub-sections. The general conclusion that can be drawn from all the studies is that respondents rarely measure aspects of the buildings' physical performance. When they do, it is done in the form of informal complaints and communications. There were no systematic ways of assessing the users' satisfaction. Virtually no one conducting any form of evaluations had any systems/tools for sharing information and implementing the lessons learned. The respondents generally seemed interested in the concept of building performance evaluation or an evaluation tool for measuring the performance of buildings. All the respondents agreed that they would use such a system or process if available to assess the performance of buildings in the universities. The negative experiences expressed by the participants point to the need for a building performance evaluation system that produces not only buildings that support educational objectives but buildings in which users or occupants are comfortable and productive.

This 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 poor performance of building facilities in this research compares with the findings in earlier studies. Buys (2009) reports that the performance levels of physical facilities in South African and United Kingdom tertiary institutions were all below bench mark ratings identified in the study. However, the performance rating for United Kingdom tertiary institutions was marginally higher than that of the South African tertiary institutions. This state of affairs throws up a great challenge to facilities and construction management professionals and re-enforces the need for improved building performance in higher education built asset management.

In this study, the analyses and interpretation of the quantitative and qualitative data has followed an iterative process. The findings from the focus group meetings and in-depth interviews highly correlate with those of the questionnaires surveys.

5.6.3 Results of walkthrough evaluations and observations

Walkthrough evaluations and observations carried out by the researcher show that space requirements for effective teaching and learning were not met. The quantitative measurements obtained from the various areas of the universities as presented in Tables 5.27 to 5.30 compare poorly with the minimum standard requirements of the National Universities Commission. This implies that building facilities procured by the universities did not comply with the standard guides which were used as benchmarks for the procurement of building spaces in the university system.

5.6.4 Best practice criteria and results of the investigation

The development of research instruments for this study was based on the performance measures and best practice criteria identified in the literature; particularly the PEB organising framework for evaluating quality in educational institutions, codes and standards. The performance criteria from the literature review show that:

- Educational buildings must be fit for purpose in terms of accessibility to all including vulnerable and disabled users. The criteria for this include students' capacity; that is, sufficient learning spaces and support facilities to accommodate at least 95 percent of the student enrolment; learning spaces in terms of flexibility of classrooms, libraries, workshops and laboratories, comfortable spaces; for example, furniture, lighting, noise and temperature, new technologies, social spaces, staff spaces and community use;

- Building facilities must be symbolic, visually pleasing and educational; the criteria for this include issues such as aesthetic appeal and educational tools;

- Building facilities must be fit for purpose relating to operational layout; this refers to cost effectiveness, management and operational systems, feedback loops and design selection involving users;

- Building facilities must provide a healthy and safe environment in terms of portable water, sanitary facilities, fire safety, and lighting, secure design, safe finishes and safe vehicular and pedestrian traffic; and

- Facilities must be environmentally sustainable in terms of site planning, sustainable systems, methods and materials.

This study has shown that building performance in the case organisations did not meet most of the above criteria. Evidence from the study also show that the level of perception and awareness of evaluation is low (hypothesis 8) and building performance generally seem to be unpredictable in terms of quality standards and user expectations.

All the investigations have confirmed some of the trends in the education sector uncovered in part one of the literature review. Specifically, the studies confirmed the lack of interest in building performance evaluation by management and the inability of physical planning/building facilities units of the case organisations to integrate their functions with that of the core business of the institutions. The building facilities units 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**.** Evidence from the case studies shows that knowledge and perception of building performance evaluation is poor; therefore the terrain is largely unexplored. However, a change must be initiated due to globalisation of the construction industry.

The researcher observed during the field investigations that some of the construction professionals were willing to work with evaluations but they need to be encouraged to do so by top level management because the successful implementation of a new way of thinking lies with the ability of management to motivate the employees (Olomolaiye and Egbu, 2006). The next section presents a proposal for a building performance evaluation system or model for educational buildings.

5.7 Building performance evaluation model/system

The concept of building performance evaluation is one of the major theoretical backgrounds of this study. It is a system that allows facilities managers to identify and evaluate critical aspects of building performance systematically (Barrett and Baldry, 2003). The concept is

attractive not only to facilities managers, but also to designers, users and those concerned with the built environment. It is therefore hardly surprising that building performance evaluation is becoming an important and regular part of the building delivery process.

One of the objectives of this study was to develop/recommend a building performance evaluation system that would incorporate best practice criteria for the evaluation of educational buildings. The PEB organising framework provides a platform for the development of a measurable standard of performance for educational building spaces and further highlights the role of building facilities in increasing access and equity in education; improving educational effectiveness; promoting the acquisition of key competencies and optimising building performance and operations. Although, the evaluation of building performance appears not to be a common and regular activity in the case organisations, the respondents generally desired an evaluation process that would guide them in implementing or improving the performance of their existing and future building stock.

The literature review has shown that a building performance evaluation process must first identify best practices and critical areas for improvement within the organisation; identify techniques or methods that will lead to better performance; implement and measure the outcome and then feedback; stating the lessons learned (Amaratunga, 2000; Sanoff, 2003; Preiser, 2005). The criteria for best practice and critical areas for improvement have been identified in this research. The model or evaluation system that will be recommended for building managers to appraise the performance of their buildings is based on the best practice criteria identified in the literature and case study investigations. The results of the survey show that some variables are very critical to the performance evaluation process (hypotheses 1-8). Thus, any performance evaluation system or model that can be used for decision-making must consider these variables.

5.7.1 Building performance evaluation process in organisations (the balanced scorecard approach).

The implementation of building performance evaluation in an organisation requires a regular and on-going process. The balanced scorecard (BSC) model (as described in section 2.10.1) provides a good alternative for the management and implementation of building performance evaluations in an organisation. The organisation could use, report and follow-up evaluations

in the balanced scorecard (Palm, 2007). Figure 5.24 describes the implementation strategies of the BSC model.

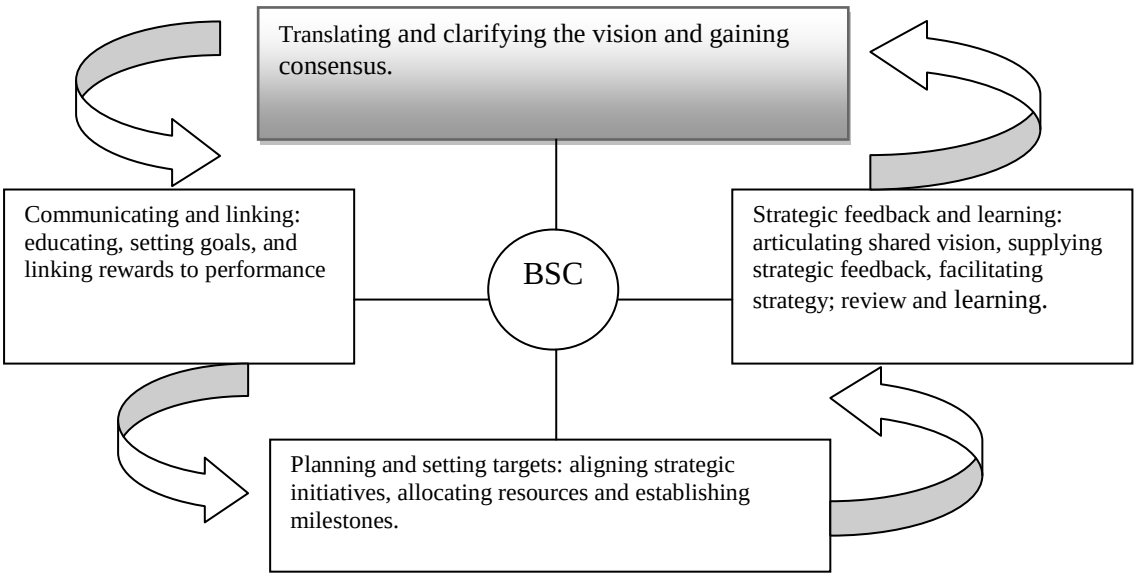

Figure 5.24 BSC implementation strategies (Kaplan and Norton 1996:78)

Translating vision refers to minimising the gap between management ideas about how vision should be implemented in the organisation and the employees' knowledge about how their actions can contribute to the realisation of the vision. Top management must therefore translate the vision into terms that have meaning and understood by the employees that must realise the vision.

Communicating and linking refers to how an individual employee's performance aligns with the overall strategy of the organisation. Everyone in the organisation must know what the organisation intends to achieve for shareholders and customers. *Business planning* is all about creating support and integrating the organisation's strategic planning and budgeting process to ensure that the budget supports the organisation's strategy. Similarly, *feedback and learning process* involves working with feedback and learning in developing, setting and accomplishing new goals and visions within the organisation. This helps the organisation to see what went well or badly and to ensure that the organisation does not make the same mistakes in the future. It also means that the organisation must maintain or retain the good things in the organisation. Simply put, feedback and learning are vital for the organisation to accomplish its vision and goals.

The key issue in the BSC model is that it establishes the existence of causal relationships among variables within an organisation. For example, how a change in budget or management decision causes changes elsewhere. The assessment of the performance of building facilities in an organisation can help to create causal relationships that are tied to organisational mission and goals. The relationships may initially be in the form of hypotheses that can be tested with logic, multiple evaluations or with statistics (Amaratunga, 2000). It must be noted that the identifiable cause-and-effect relationships in the model are important in choosing the appropriate indicators. The performance indicators discussed in the literature review provide the identifiable cause-and-effect relationships. The BSC model clearly demonstrates the hypothesised cause-and-effect links or relationships postulated in section 1.5 (see hypotheses 1-8). The development and recommendation of a building performance evaluation model for this thesis is therefore guided by the BSC measurement or evaluation process.

5.7.2 The Model

Evaluation of buildings with a focus on the user contributes to the organisations' knowledge and improved building performance. Knowledge about the requirements of users and constant use of information to procure and manage buildings must therefore be considered as central for designers and building service providers. Thus, the proposed model focuses on how organisations should work with evaluations based on user satisfaction. This study has shown that the case organisations (universities) do not have a good process for managing building performance related problems and staff responsible for the management of buildings (facilities managers) spend little time on understanding if long term measures were really working.

Besides, organisational processes were not strategically focused. This necessitates the development of a building performance evaluation tool or approach which could help the facilities and building managers in the organisations to plan, anticipate and initiate change for improved services and strategic growth. The model provides the organisations with the basis to assess how well they are performing towards their predetermined performance objectives. An outline and description of this approach is illustrated in Figure 5.25.

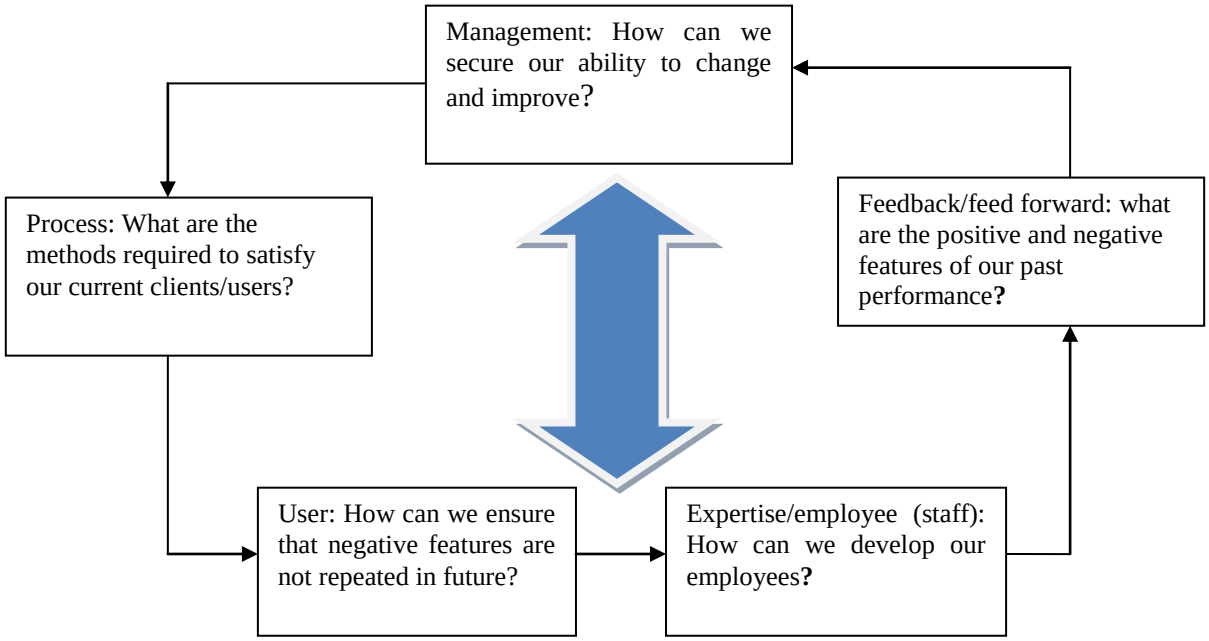

Figure 5.25Building performance evaluation process model focusing on the user.

The model in Figure 5.25 describes the relationships among the various perspectives of a performance evaluation process based on the balanced scorecard. This approach recognises the best practices identified in the study and when internalised, it can transform the current state of affairs in the organisations to a systematic way of solving performance related building problems. The model focuses on five perspectives; namely, the management vision, process, user, expertise/employee and feedback. This is consistent (in part) with the four perspectives adopted in Kaplan and Norton (1996). Areas of potential improvements are identified easily and can be monitored over time to gauge the extent of improvement achieved.

The model shows how management can improve and develop through the feedback/feed forward mechanism. This approach is driven by the desire to make decisions that are in line with what the users want. The present way of managing buildings must change and to succeed, top management must initiate the change by introducing routine building performance evaluations, supporting tools and incentives. Accordingly, the above perspectives are explained as follows:

5.7.2.1 The management vision: This perspective addresses the institution's desired future situation. This means that the building performance objectives/criteria developed in each perspective must support the fulfilment of the institutional strategic objectives. The performance objectives determine what is to be evaluated and in this model, they include functionality; accessibility; productivity; health and safety; cost effectiveness; aesthetics; and environmental comfort. The model makes it easy for the vision and mission to be broken down into these identifiable and measurable objectives that are considered crucial to the attainment of institutional goals.

5.7.2.2 The process perspective: This focuses on how the working methods of future projects should be carried out; how the information regarding positive and negative features of past performance should be evaluated and how to handle and share the information in the best way. Simply put, it relates to the efficiency and effectiveness of building related services within the organisation.

5.7.2.3 User perspective: The next perspective is the user perspective which focuses on how the buildings should perform in future. This ensures that the negative features identified through the performance evaluation process are not repeated and that the positive features are repeated in the design process. This can be achieved through the integrated design process involving all stakeholders.

5.7.2.4 The expertise/employee: This perspective concerns how the lessons learned can be shared. This perspective also concerns the building of a learning culture by management to ensure that staff members with the most potential are trained. This involves skills and competency development, frequency of training programmes and adequate support for change.

5.7.2.5 The feedback perspective: The feedback perspective is in the form of an action plan for completing the scorecard. It describes the specifications and steps to be taken to achieve the desired performance level. It comes in form of corrective action. The feedback /feed forward mechanism serves to ensure that the organisation performs better and learns from both successes and failures. Management must always take the past successes into account and must never repeat the past failures in the future.

This model modifies the balanced scorecard with some differences in the identification of antecedents to the model. As stated earlier, it demonstrates how the use of BSC in the evaluation process can lead to the organisations getting a picture of what the users want and how the employees in the organisation can improve and develop through the process. It is necessary for the organization to work with the questions in this model if they are to improve building performance and knowledge about evaluations. The model assumes that by implementing perspectives such as user, process, employee/expertise and feedback in the organisation's balanced scorecard, its management would be able to conduct effective evaluations.

The BSC model is an effective tool in communicating the desired results and so represents a vision of how stakeholders can be involved and their input recognized in the planning and design process. The implementation of building performance evaluation model in Figure 5.25 could ensure that activities are focused and that users (staff and students) get the satisfaction they desire from buildings; that employees are better trained; and that more efficient educational institutions and a stronger brand or organizational image is achieved.

5.8 Framework for effective implementation of a building performance evaluation system

The literature in this study shows that evaluation is an effective tool for the improvement of building performance programme. Nevertheless, for an organization to make effective use of the results of evaluation, it must be willing to transit from measurement/assessment to management. Building performance evaluation results should be used to effect a positive change in the organizational processes, cultures and systems (Palm 2007:74). This can be achieved by setting goals, prioritizing resources and informing managers to either confirm or change current policy directions.

The building performance evaluation problems identified in the case organizations by this research should be addressed by top management of the institutions. The model forms part of the information and tools needed to identify and assist management and facilities managers to improve the performance of existing and future buildings in the institutions. In this regard, the following areas should be considered for an effective implementation of a building performance evaluation process or system.

5.8.1 Performance evaluation plan

A performance evaluation data base and plan should be created to provide information on performance standards and cost of performance evaluation activities. This would help to improve the effectiveness of design and evaluation processes. The absence of a performance evaluation data base and plan was a major barrier to the systematic and effective building performance evaluation in the institutions investigated. An evaluation plan serves as a budgeting tool that provides an overall picture of related or shared performance evaluation requirements of buildings. It does not only ensure that the user derives optimal satisfaction from the building but also ensures that the building life and value are sustained.

5.8.2 Design input

The current practice of commissioning only Architects and Engineers in building procurement should not be encouraged. When new building facilities or the modifications of existing ones are being proposed, facilities managers acting as surrogate clients or stakeholders and value managers should form part of the design team to assist in making decisions about user needs and value management. They can also provide information regarding the creation of building performance evaluation plans for the institutions. This will help to eliminate such design shortcomings as those identified in the case organizations by the focus group participants.

5.8.3 Feedback/feed forward mechanism

An effective feedback system for the evaluation of building performance should be established in the institutions. This implies that information regarding the preferences of the users and other performance requirements should be made available to the designer through the feedback mechanism. The feedback mechanism must identify the building performance failures and successes. This means that the negative and positive features of the building should be clearly highlighted in the evaluation process. The negative features should not be repeated but the positive features may be repeated or improved. Feedbacks from users/occupants are very important because they have the greatest experience of building needs. This places a greater responsibility for briefing on the user and therefore should not wait and only complain about the results of building performance (Buys, 2004:182).

5.8.4 Budgeting/finance

The institutions' budgeting process and strategic planning must be integrated to ensure that the budget supports the strategies. Building performance evaluation budget should therefore be based on the financial implications or cost set out in the building performance evaluation plan and not on extemporized basis. The budget should provide for the salaries and wages of staff in the building unit of the institutions. It must also identify periods in the year when building performance evaluation issues can be expected; for example, the beginning of new academic sessions and provision for funding made for them.

5.8.5 Communication

There should be a two-way communication system in the institutions. The communication line between top management and the facilities management department must be effective to ensure that follow-up procedures are maintained. Employees must know what the organisation intends to achieve for stakeholders and users. This also implies that the communication lines between the facilities managers and users are effective to ensure that performance issues raised by the users are promptly addressed. Telephone and personal messages should be correctly received and relayed to the right person in the institutions.

5.8.6 Staff/ personnel development

The institutions must have sufficient staff to plan and execute building performance evaluation plans. The staff may be in-house, outsourced or a combination of both to provide this service. There must be an employee development plan for the in-house staff to encourage continuous learning in core competencies. Staff should have the capacity to process information for the development of knowledge in performance evaluation. Professionalism and research should also be encouraged.

5.8.7 Organisational structure

The organisational structure should not be rigid but flexible to encourage in-house or outsourced personnel to perform specific building performance evaluation functions. Facilities managers should be capable of taking prompt decisions as the need arises. The performance evaluation system should provide the necessary information for decision-making such as funding arrangements. The current organisational structures in the institutions studied are rigid and do not allow for prompt decision-making. A facilities management department housing the building performance evaluation unit should be included in the

physical planning structure of the institutions. The proposed organisational structure of such a department is shown in Figure 5.26.

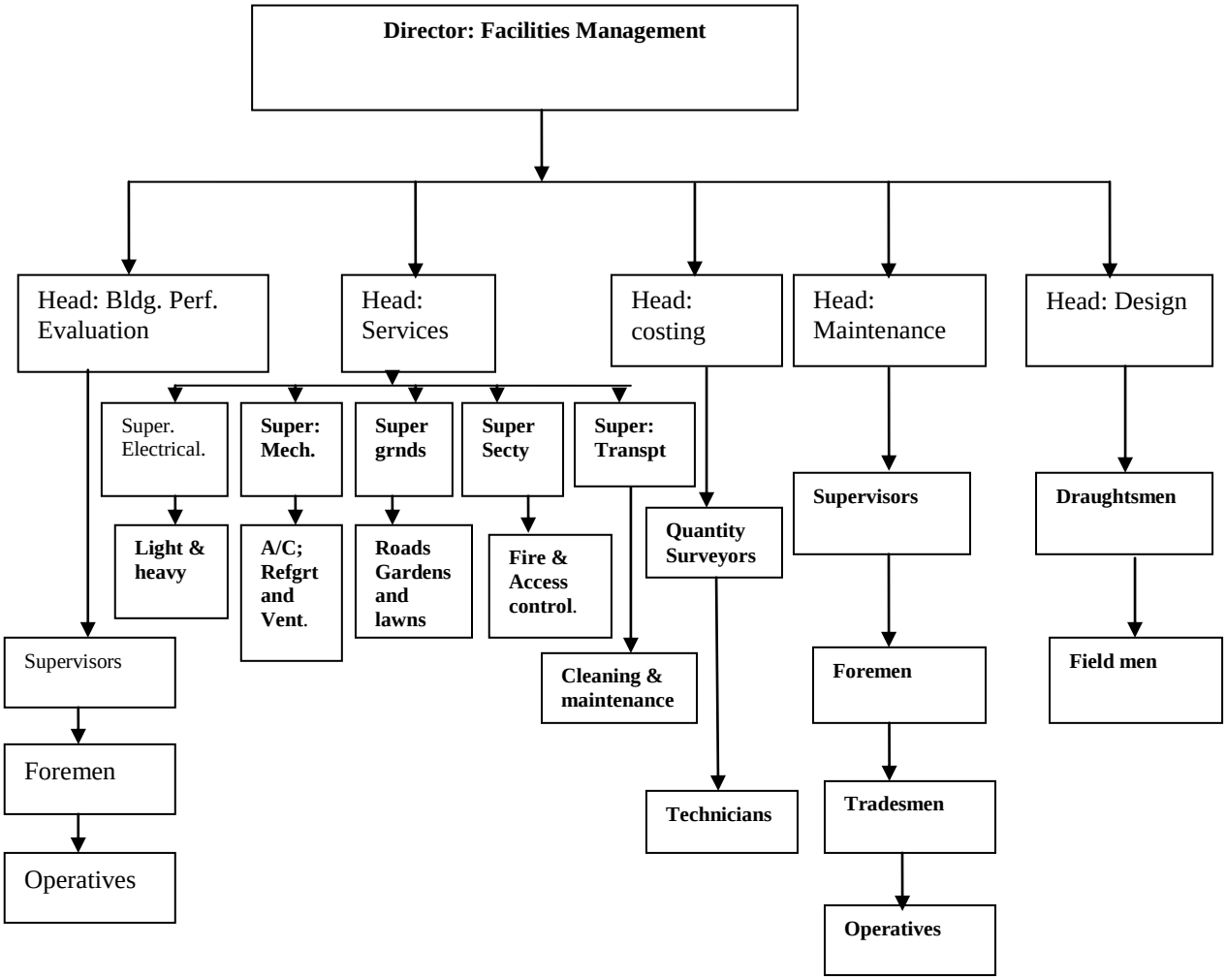

Figure 5.26 Proposed Facilities Management organisational structures

CHAPTER 6: Summary, Conclusions and Recommendations

6.1 Research overview

This study is concerned with the evaluation of building performance within the context of university environments in South East Nigeria. This was necessitated by the recent expansion in higher education participation which presents tremendous challenges to the university system in terms of building infrastructure, funding and environmental concerns. The explosion in students' enrolment without a corresponding increase in funding from government has resulted into functional inadequacies of building facilities in the system. To provide a solution to this challenge, the thesis explored the utility of building performance evaluation as a facilities management toolkit for improving the functional effectiveness of buildings. The thesis further demonstrated how this can be achieved by developing a conceptual graphical model based on the balanced scorecard. The model provides a systematic process of evaluating the performance of educational buildings based on user satisfaction. Its potential to promote learning capacity and educational effectiveness lies on a clear understanding of user needs and performance objectives at the outset of the procurement process.

In pursuing the aim and objectives of the research, a multi or mixed method strategy was adopted with particular reference to the case organisations within which the practice of building performance evaluation would take place. The case studies in the research presented a reasonable unit of analysis for the evaluation of the practice of building performance evaluation at a qualitative or subjective level. Qualitative instruments such as interviews and focus group discussions were used to generate important constructs or themes from the target population. This was followed by a quantitative method of data production comprising the design, pre-test and administration of structured questionnaires in all the four universities studied.

Data and information obtained from the quantitative research instruments were used to test the hypotheses. Accordingly, eight hypotheses guided the gathering and analyses of data and interpretation of results in line with the research problems and objectives. The thesis has endeavoured to provide a descriptive account of building performance evaluation and how the concept could be operationalised into a management tool for building and construction

management. In this way, the thesis has both theoretical and practical relevance to the building industry.

This chapter provides a summary of key findings of the research and conclusions with particular reference to the problems and research objectives identified in chapter 1. It also states the contribution to knowledge, areas for further research and recommendations.

6.2 Research problems

In summary, the main problem addressed in this research may be stated as follows:

- Most educational institutions in Nigeria do not regard building performance evaluation as an area of legitimate interest; do not lay emphasis on the user-value of buildings and therefore procure buildings that are not adaptable, flexible and fit for purpose.

From the above problem, the following sub problems were identified:

S-p 1: Educational institutions do not lay emphasis on performance and user-value in the procurement of building facilities;

S-p 2: Building performance evaluation in educational institutions appears too trivial and does not fit into building procurement and funding stereotypes;

S-p 3: A significant number of building facilities in educational institutions are not fit for purpose;

S-p 4: Critical performance indicators/mandates are often absent in the design, construction and management of buildings in educational institutions;

S-p 5: Building facilities in educational institutions are overstretched and inadequate for effective learning and teaching;

S-p 6: There are no feedback mechanisms in the design and management of buildings in educational institutions;

S-p 7: Building facilities in educational institutions are not adaptable and flexible; and

S-p 8: There is low perception and awareness of building performance evaluation among stakeholders in educational institutions.

To address the above research problems, eight hypotheses listed in section 5.4.1 were postulated. Data for the hypotheses were generated through the questionnaire surveys and

analysed as shown in section 5.4.2 and Table 5.19 respectively. The results of the testing of hypotheses as ranked in Table 5.19 showed that:

- Lack of an effective feedback mechanism results in poor design and procurement of unsuitable buildings;
- Buildings that are not adaptable and flexible do not respond to the demands of changing needs;
- Level of perception and awareness of building performance evaluation is low and impacts significantly on building improvement policies;
- Inadequate building facilities and spaces for learning and teaching affect academic performance;
- Lack of critical performance indicators/mandates in building design impact significantly on user satisfaction;
- Funding of building performance evaluation is below best practice standards;
- Building facilities that are not fit for purpose impact negatively on teaching and learning; and
- Emphasis on building performance and user-value does not necessarily enhance design and organizational effectiveness in educational institutions.

The above hypotheses were postulated in line with the research problems and related to measurable characteristics of building performance evaluation practices identified in the literature (section 3.4.9) as key performance indicators. The identified performance variables include space, fitness for purpose, adaptability and flexibility, funding/cost effectiveness, comfort, productivity, security, health and safety. These measurable aspects (qualitative and quantitative) of building performance are consistent with findings of the evaluation of educational buildings (Preiser, 2002; Leaman, 2003; Sanoff, 2003; OECD, 2006; Palm, 2007).

The results of the hypotheses tests indicate that all the claims were supported by a significant proportion of respondents in the study except the first hypothesis (Table 5.19). This means that the null hypothesis in section 5.4.3 was not rejected. That is, emphasis on building performance and user-value do not enhance design and organizational effectiveness in educational institutions. However, results of the interview and focus group meetings

supported this hypothesis which suggests rather that emphasis on building performance and user-value actually enhances design and organisational effectiveness.

These results suggest that designers and service providers neither understand user needs nor the objectives of procuring educational buildings in the organisations studied. This development is an indictment for the building industry and therefore requires urgent steps to reverse the trend. The above findings from the study therefore support the hypotheses and addressed the research problem and sub problems as formulated in chapter 1.

6.3 Aim and objectives

The aim of this research was to develop an appropriate model for building performance evaluation in higher education institutions based on key performance indicators; for improved awareness, understanding and practice. In line with this aim and to address the research problems, the following objectives, which provided direction to the research, were formulated:

- To utilise the performance concept to identify the key performance indicators in educational buildings;
- To appraise the nature and type of building facilities in the targeted universities;
- To determine the suitability of the buildings and establish the extent to which they enhance both educational and operational effectiveness;
- To identify and resolve major space and evaluation/environmental problems in the existing building facilities of the targeted universities; and
- To develop a performance evaluation model that would incorporate best practice criteria for educational buildings.

6.4 Fulfilment of the research aim and objectives

For purposes of clarity, the summaries of key findings of this research are correlated with the objectives that were originally set out to guide the research process. As earlier stated, the aim of this research was to develop an appropriate model for building performance evaluation in higher education institutions based on key performance indicators; for improved awareness, understanding and practice. In pursing this aim, five objectives were established. The achievement of each of the five research objectives is discussed in the following subsections.

6.4.1 Objective 1

To utilise the performance concept to identify the key performance indicators in educational buildings;

This objective required an in-depth examination of the concept of performance evaluation with particular reference to educational buildings. This was done through an extensive review of existing literature on the performance concept, building performance evaluation and facilities management. The reference sources included books, journals, articles, conference proceedings and the internet.

The review showed that there is a functional relationship between facilities management and building performance evaluation. This relationship facilitates the change process by ensuring that operational assets such as buildings perform optimally in an organization. This promotes value creation and effective resource use. An important issue in the literature review was the fundamental role of the performance concept to building performance evaluation. It argues that any building performance evaluation process must determine the extent to which a completed and occupied building meets or satisfies the needs/expectations of the user (performance).

The literature identified the key performance measures/indicators in educational buildings as fitness for purpose, accessibility, maintenance, adaptability and flexibility, funding/cost effectiveness, comfort/satisfaction, productivity, aesthetics, security, health and safety. These measures were discussed in section 3.4.9 and broadly categorised as functional, physical/behavioural, service/psychological, economic/financial and environmental building performance measures/objectives. There was emphasis on the integration of financial and non-financial measures in the development of an effective evaluation system in an organization.

It was established that a building performance evaluation exercise must identify best practices in addressing facilities management issues. The specific best practice issues identified in the literature include codes, standards and regulations, organization and management and building sustainability. There were no existing standards for building performance evaluation in Nigeria. The NUC standard guide and PEB organising framework for evaluating quality in

educational spaces were identified and used to evaluate existing approaches to building performance evaluation in the target institutions.

6.4.2 Objective 2
To appraise the nature and type of building facilities in the targeted universities

This objective was achieved by obtaining and analysing information from the target universities in South East Nigeria using the quantitative method of data collection. Analysis of the data showed that most of the buildings provided and managed by the institutions were classroom or lecture buildings. This was followed by office buildings and residential buildings. The analysis also showed that special buildings such as exhibition halls were included in the building stock of the universities. These analyses were provided in Table 5.18 and Figure 5.19 respectively. Investigations showed that the buildings owned and managed by the universities were not utilised for external or letting purposes.

6.4.3 Objective 3
To determine the suitability of the buildings and establish the extent to which they enhance both educational and operational effectiveness

This objective was achieved by analysing both the quantitative and qualitative data obtained from the target population and results of hypotheses in Table 5.19. The results showed that the general level of performance of building facilities in the universities was poor and needed to be improved. The results also point to the conclusion from the interviews that space efficiency was poor and this might be responsible for the high level of absenteeism in the offices as shown in section 5.3.3.7 and Figure 5.12 respectively. The analysis and results of the qualitative data (focus group and in-depth interviews) showed that the buildings were unsuitable for effective academic work (hypothesis 5 in Table 5.19).The major aim of any building project is to add value for all stakeholders. For example, functional, economic, social, aesthetic and environmental values.

The concept of value management recognizes the contribution of parties involved in the building delivery process as a key requirement to the creation of value and potential success of the building project. Participants' experiences and feelings in the study showed that their interactions with building facilities in the universities did not add value to their learning and

working experiences and this hinders educational effectiveness. The findings summarised in Tables 5.14 and 5.15 and Figures 5.12 to 5.18 point to this conclusion and therefore address part of the research problem in this study. The negative experiences expressed by the participants in all the thematic groupings point to the need for building performance evaluation system that produces not only buildings that support educational objectives but buildings in which users or occupants are comfortable and productive.

6.4.4 Objective 4

To identify the major space and evaluation/environmental problems in the existing building facilities of the targeted universities

The results of the study indicated serious concerns regarding poor space conditions in offices, classrooms and residential buildings, noise, privacy and poor environmental quality. Analysis of data showed that building spaces were inadequate and not properly co-ordinated, building finishes were poor, parking spaces were insufficient and landscaping/plantings were poor. These findings point to the fact that evaluation of the physical and environmental aspects of building performance were either rarely done in the universities or done in form of informal complaints and communications. The general opinion from the study was that stakeholders desire a higher level of user satisfaction from the educational buildings (section 5.3.1.5). A successful educational building is determined by evaluating how the building is functioning, how the learners and teachers are utilizing the spaces and how the design has promoted the educational process.

6.4.5 Objective 5

To develop a performance evaluation model that would incorporate best practice criteria for educational buildings

The fifth and final objective of the research was achieved by developing a graphical conceptual model that could enable the institutions evaluate the performance of their existing and future buildings. The model provides a strategic framework which indicates the elements necessary for the achievement of overall organisational goals. Significant improvements in building performance can emerge through the application of the tool in the facilities management system. It measures performance and provides decision makers with information relating to a series of key performance indicators or criteria. The management

vision, organisational processes, the user, the employee/expertise, feedback and the key performance aspects or objectives identified in the literature and qualitative analysis are subsumed/ incorporated into the model.

From the results of investigations and analyses carried out, it could be concluded that the objectives of the study have been achieved

6.5 Summary of the main research findings

Generally, the key findings of the research can be summarised as follows:

6.5.1 Identification of building performance evaluation measures and best practices

The review of literature and case studies in this thesis revealed and identified the key performance measures and best practice criteria as fitness for purpose, accessibility, maintenance, adaptability and flexibility, funding/cost effectiveness, comfort/satisfaction, productivity, aesthetics, security, health and safety. The study did not reveal additional measures or best practices. However, analyses of qualitative and quantitative data showed that the key indicators or measures for determining how well a building is performing for users in the institutions were functional comfort of the space design or indoor environmental quality. However, there was neither a comprehensive benchmark instrument nor a national data base for the measurement of building performance in educational buildings.

Generally, fitness for purpose in educational buildings is all encompassing and this entails accessibility to all including vulnerable and disabled users. The criteria for this include students' capacity; that is, sufficient learning spaces and support facilities to accommodate at least 95 percent of the student enrolment; learning spaces in terms of flexibility of classrooms, libraries, workshops and laboratories, comfortable spaces; for example, furniture, lighting, noise and temperature, new technologies, social spaces, staff spaces and community use. It also relates to operational layout; this refers to cost effectiveness, management and operational systems, feedback loops and design selection involving users. Educational buildings must also be symbolic and visually pleasing in terms of aesthetics. The literature also pointed out that educational buildings must provide a healthy and safe environment in terms of portable water, sanitary facilities, fire safety and lighting, secure design, safe finishes and safe vehicular and pedestrian traffic. Analyses of data in this study showed that building performance in the case organisations did not meet most of the above criteria.

6.5.2 General building performance and environmental concerns

With regard to the general level of building performance and environmental concerns, the following were the key findings:

6.5.2.1 Design of building spaces and learning environments

- Space efficiency in most of the buildings such as classrooms, offices and residential accommodations were found to be poor and this could be responsible for the high level of absenteeism by the academic staff;
- The greatest assets of the buildings in terms of design and learning environments include good accessibility to the libraries, sufficient classroom headroom, adequate day lighting, sufficient land for future expansion and visitor-friendly;
- From the findings, it was apparent that the interaction between users and building facilities in the universities did not add value to their learning and working experiences;
- The building design process did not consider inputs from users/stakeholders at the outset and this explains why there were no feedback mechanisms in place;
- Building spaces were poorly co-ordinated and adapted. The safety and security conditions of the buildings were also poor; and
- Analyses of the survey showed apparent lack of a systematic mechanism for measuring the success or performance of completed and occupied buildings.

6.5.3 Challenges/ constraints to building performance evaluation

The major challenges or problems identified in the study include:

- Lack of funding or insufficient budgets for the building and works departments of the institutions;
- The institutions or case organisations lacked skilled and experienced personnel or manpower to carry out performance evaluation exercises;
- Unavailability of a performance evaluation database and standards for building performance evaluation;
- The findings showed that lack of commitment by management and ethical reasons were part of the constraints for building performance evaluation in the organisations.
- It was found that professionals, especially designers protect their territories and do not engender critical evaluation of their designs for poor performance.

- Evidence from the study also showed that the level of perception and awareness of evaluation is low (hypothesis 8 of Table 5.19).

The findings in this research corroborate and confirm the observations and reports of authors on the state of building facilities in the Nigerian university system. The lack of adequate and functional building facilities in Nigerian university system constitutes enormous threats to educational effectiveness and system performance. Consequently, the standards and quality of education, to some extent may be compromised.

These findings and results of the hypotheses further addressed the research problems formulated for the research

6.6 General Conclusion

Literature from the study has established that educational institutions are in the business of knowledge transmission and promotion of learning capacity. This is facilitated through the use of space provided by buildings as an enabler. The physical condition and functional effectiveness of buildings is therefore critical for educational effectiveness. Performance evaluation of educational buildings ensures that buildings meet the infrastructural challenges of educational institutions. This implies that the effectiveness of buildings is not just maximized in terms of occupancy costs but also with respect to user satisfaction. However, literature from the study has shown that evaluation of building performance is not yet a mainstream activity in the Nigerian construction industry and therefore has not taken full advantage of the potential benefits of evaluation.

This research has shown that the level of perception and awareness of evaluation is low and building performance generally seems to be unpredictable in terms of quality standards and user expectations. The building performance evaluation constructs and related concepts are not well established in the case organisations. Thus, the standard of approaches to building performance evaluation and funding is below best practice level and performance criteria. The field studies conducted showed lack of interest in building performance evaluation by management and the inability of physical planning/building facilities units of the case organisations to integrate their functions with that of the core business of the institutions. The building facilities units appear to be satisfied with the status quo and are contented with the adoption of reactive rather than proactive responses to service delivery and demand.

However, during the field investigations, the researcher observed that some of the construction professionals were willing to work with performance evaluations tools but they need to be encouraged and accepted by top level management.

The general conclusion that can be drawn from the research therefore is that the universities/organisations rarely measure aspects of the buildings' physical performance and when they do, it is done in the form of informal complaints and communications. There were no systematic ways of assessing the users' satisfaction. Almost no one conducting any form of evaluations had any systems or tools for sharing information and implementing the lessons learned. It can also be concluded from the study that evaluation is a missing link in the building delivery process and for this reason; most buildings do not satisfy the needs of the end user in the case organisations. Building performance evaluation has been analysed under the functional and social environments of the case organisations and this has allowed the generation of valuable design database to fine tune the performance and procurement of both existing and future buildings in the universities. If the user needs are to be satisfied, a detailed evaluation and feedback mechanism must be put in place and frequently implemented.

The institutions and construction professionals/facilities managers in the study have been urged to adopt the building performance evaluation model based on the BSC as a tool to address the functional inadequacies of building facilities in the university system in Nigeria. This tool allows for a more supportive environment for user activities by measuring the performance of a building in use and providing decision makers (management) with information relating to a series of key performance criteria as identified in the study. For an effective use of the results of this evaluation, the universities must be able to make the transition from technical measurement to management of buildings. The performance evaluation results should be used to effect positive changes in organisational cultures, systems and processes by prioritising resources and informing managers to either confirm or change current policy directions to meet organisational mission and goals. In this way, the universities would move away 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.

6.7 Contribution to knowledge

The key contributions to the body of knowledge in this research include that:

- **The research has developed a clear theoretical understanding of basic constructs and related concepts of building performance evaluation with regard to construction and educational building facilities management in South East Nigeria.**
- **The research has developed a bespoke methodology to achieve its objective of evaluating the performance of educational buildings in South East Nigeria.**
- **The research has generated a qualitative and quantitative assessment of building performance within the university environment of South East Nigeria.**
- **The research has identified performance evaluation of buildings as a missing link in the building delivery process; a lacuna that has hitherto created gaps between building users and design practices.**
- **The research has provided an understanding of the barriers and challenges of building performance evaluation practices within the university setting in South East Nigeria.**
- **The study has diagnosed the user needs phenomenon in educational buildings and therefore increased the awareness and perception of building performance evaluation in the South East Nigerian university environment.**

The assumption in this thesis is that building performance evaluation by definition helps to improve organisational effectiveness or performance. The researcher therefore believes that a research into the key ideas underlying building performance evaluation and best practices may open a window of opportunity for achieving higher efficiency and effectiveness in the management of educational building facilities.

6.8 Critical evaluation of the research approach, techniques and limitations of study

Given the philosophical underpinnings of this research, the approach adopted was both qualitative and quantitative or mixed method. The principal means of data collection was reviews, interviews, questionnaires, audio taping, photographs, walkthroughs and direct observations. The purpose of the questionnaires was to corroborate the information provided in the literature as well as provide the quantitative data for hypotheses testing. The qualitative

approach enabled the researcher to acquire a better understanding of the feelings, attitudes, experiences and perceptions of stakeholders in the case organisations regarding building performance evaluation and how this affects educational effectiveness. A rich description of the respondents/stakeholders and the setting enhanced certain aspects of the study. The role of the quantitative data throughout the research was to support the qualitative findings. Simply put, although the researcher made use of questionnaires and graphic representation to illustrate data which are associated with quantitative research, this study was primarily a qualitative case study. However, both methods were employed and used in a complementary manner with the research benefiting from the advantages associated with each of the methods while at the same time avoiding the weaknesses of each.

Since the study focuses on individuals or groups (staff, students and design/construction professionals) in order to understand their perceptions of building performance in the universities, the case study strategy /design was adopted. The outcome was an in-depth description and enhanced understanding of the various issues related to building performance evaluation in the universities. The multiple case studies was chosen because the researcher needed to inquire about building performance evaluation activities and developments that occurred at the four Federal Government universities in South East Nigeria and to establish whether the competencies or inefficiencies existing in one university were replicated in a different setting. This design was descriptive in nature and therefore provided substantive information about the individual universities.

The sampling strategy adopted for the study was sequential involving first the stratified random sampling for the questionnaire administration and purposive sampling for focus group discussion and interviews. The need for informative subjects who can contribute and expand the phenomenon under investigation as well as the need for small sample size for the interviews informed the choice of purposive sampling. This approach helped to capture the views of the various stakeholders involved in the investigation.

The use of mixed method and case studies provided clarity and further enhanced the validity of the research. The multi-methods strategy for data collection and analyses allowed for triangulation. Different methods of data collection were used to corroborate the effect of building performance on the users and this addressed issues of internal validity. The

researcher made a statistical presentation of data in form of graphs and tables and then presented a narrative interpretation of the findings.

The limitations of case study research and the ways in which the researcher in this study attempted to overcome the limitations were discussed in section 4.9.3 and 4.9.10 of chapter 4. However, there is need for a brief recapitulation of the limitations in this section.

The constructs applied in this research were drawn from the literature review and field surveys as demonstrated in the above discussions. The data collection phase of the case study included a series of interviews (focus group and in-depth interviews), and document (standard guide) evaluation from the case organisations and the NUC. For the purpose of this study, the focus was on the users or stakeholders (staff, students, designers and building service providers) and this generated some limitations to the study.

The first limitation of this study relates to the nature of the topic and strategic responses. Obtaining candid responses on sensitive information such as building performance in a university setting was not easy. To minimise this influence, indirect questioning was adopted during the interviews and questionnaire design. Another limitation in this respect is the problem of case study research on its own. Although qualitative research involves studying the respondents in their natural setting, no research can truly capture the full effect of the setting or the respondents because they are complex entities (Gay and Airasian, 2003:19). Respondents may not provide the researcher with the true reflection of events due to lack of understanding or time constraints. These issues are problematic and may not have allowed the free flow of information.

Coverage of this study was limited to four (4) institutions as a compromise for in-depth studies. More representative views would have been obtained if other geo-political zones of Nigeria were interviewed. However, the uniqueness of this geo-political zone as explained in section 4.9.3 and the literature review minimised the influence of the limited scope on the reliability of the study findings.

Again, during the research, the respondents were informed about the research and assured of anonymity and confidentiality. This, according to Gray and Airasian (2003:19) are regarded as a limitation because the researcher, being involved with human beings will have to

consider numerous ethical concerns and responsibilities to the respondents. It is difficult therefore to assess the extent to which these assurances allayed the fears of the respondents in the study. Furthermore, the respondents particularly the focus group meetings may have conceived of research as a means of showcasing their displeasure for the inadequate funding and building infrastructure in the university system in Nigeria. There is therefore the likelihood that the level of building performance evaluation and practices in the study were affected by these issues.

It has been argued that it is impossible to generalise findings for a whole population from few case studies and that the intension of case studies is to establish general conclusions from particular facts and circumstances (Nieto and Perez, 2000). In this study, although the adoption of purposive sampling may have reduced the generalisability of the findings, the adoption of random and non-random sampling techniques as well as mixed method involving both quantitative and qualitative data addresses the issue of generasibility in the research.

6.9 Recommendations

Based on the results of this study, the following recommendations are made as effective means of improving the performance of buildings in the educational institutions of South East Nigeria.

6.9.1 Recommendations for Higher Education Institutions/Universities

- Performance evaluation of building facilities in Nigerian universities requires substantial attention to address the issue of low perception and awareness of the importance 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 as a facilities management function and its role in supporting the core business of the universities system;
- The universities should establish clear institutional building performance objectives and communicate same to the works and building departments or parties involved in building service delivery. This will help the institutions to gather information on user needs or stakeholder expectations through the evaluation process and address them;

- 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. The performance evaluation professionals should also help in drawing a sound performance evaluation policy and ensuring that funds are available for evaluation exercises;
- A flexible organisational structure such as the one proposed in this thesis should be introduced in works and services departments of the universities so that in-house or outsourced staff can be used for specific performance evaluation functions;
- Constant training and development of staff on building performance evaluation to keep up with latest technology should be encouraged by the institutions; and
- Building performance evaluation should be incorporated into building and facilities management programmes as well as the training of built environment students to provide more skilled personnel on building performance evaluation.

6.9.2 Recommendations for Policy Makers/Governments

- The Nigerian 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 and best practices; applying the model developed as part of this study; or consulting experts or professionals in building performance evaluations.

6.9.3 Recommendation for the Nigerian Construction Industry

- It is recommended that design and construction professionals rethink the current practice of disbanding or quitting the stage once the building projects are completed;
- A performance evaluation database for buildings in educational institutions should be developed in Nigeria. This would provide information on performance standards and cost of performance evaluation activities thereby helping to improve the effectiveness of design and evaluation process;
- An integrated approach to the design process should be adopted in the procurement process. This will minimise or completely eliminate the protection of professional territories by some design professionals; and

- Building performance evaluation should be part of the procurement process. This would enable the design and construction teams to investigate or evaluate the extent to which completed buildings meet the performance objectives.

6.9.4 Recommendations for Facilities Managers

- Proper implementation of feedback mechanism from the user to the designer should be maintained. This will encourage users to report any building performance aspect that should be addressed in future to the design and building team.

6.9.5 Recommendations for Researchers/Academics

- More research should be conducted in the area of building performance evaluation as a facilities management function. Other research opportunities are recommended in the next section as areas for further research.

6.10 Areas for further research

The following recommendations for further research are essentially driven by the building performance evaluation strategies/findings of this research**.**

- The limitations discussed in section 6.8 of this study could be overcome by conducting further research into the performance of educational buildings in other parts of Nigeria. Analysing the gaps between the results of such research efforts and those presented in this study could provide an important feedback to educational building facilities managers and other building service providers.
- There is need to reveal more building performance evaluation measures or indicators relating to users in educational institutions as there seem to be opportunities for such explorations beyond the case organisations studied.
- The case studies in this research were on Federal educational institutions (public service based) and so there is need for research into the application of the concept in private institutions to increase the generalisability of the findings.
- There is need to understand the relationship between different types of performance measures/indicators, for example, user related measures and organisational processes.

- The present study is essentially a user-based building performance evaluation. There is need for an expert-based building performance evaluation to determine the performance of educational buildings in terms of their structural integrity/robustness.
- There is need to determine the cost-benefit analysis of implementing building performance evaluation systems in educational institutions to establish the extent of value added.
- The key issues identified in this research need to be explored further. For example, the lack of skilled personnel in building performance evaluation makes the effective implementation of the tool daunting. Again, a study exploring the contribution of building performance evaluation to educational effectiveness is recommended.

6.11 Closing remark

This chapter has provided the summary and recommendations for this research. The next section looks at the references used in the research as well as the appendices of documentation used in the conduct of the research.

6.12 Caution

The recommendations in this study should be adopted with caution as the findings at this stage are only hypotheses based on a small sample frame. This is further explained by the methodology and exploratory nature of the research.

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Appendix 1

Letter of Introduction for field surveys

Nelson Mandela Metropolitan University

for tomorrow

• PO Box 77000 • Nelson Mandela Metropolitan University
• Port Elizabeth • 6031 • South Africa • www.nmmu.ac.za

SUMMERSTRAND NORTH
DEPARTMENT OF CONSTRUCTION MANAGEMENT
Tel . +27 (0)41 504 2394 Fax. +27 (0)41 504 2345
winston.shakantu@nmmu.ac.za

20th May 2010

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.....
.....

Dear Sir/Madam

PhD Research Thesis: Mr Kevin Chuks Okolie

I wish to confirm that the bearer of this letter, Mr Kevin Chuks Okolie is a bonafide PhD candidate in the Department of Construction Management within the School of the Built Environment at the Nelson Mandela Metropolitan University in Port Elizabeth, South Africa. His thesis project is titled "***Performance Evaluation of Buildings in Educational Institutions: A case study of Universities in South-East Nigeria***"

Kevin is now in the process of carrying out his field studies part of which will require input from focus groups and individuals occupying or working in buildings belonging to Federal Universities in South-East Nigeria. The purpose of this letter is to request you to provide Mr Kevin Okolie with every possible assistance by providing necessary information including the filling of his questionnaires and attendance of focus group discussion meetings.

Should you have any further queries regarding Mr Kevin Okolie, please do not hesitate to contact me in the Department of Construction Management.

Thank you for the opportunity to introduce Kevin. Should you require any further information, please do not hesitate to contact me on the e-mail address provided below.

Yours sincerely,

Winston M.W. Shakantu
Professor of Construction Management (Environment and Services)
Email: Winston.Shakantu@nmmu.ac.za
Tel: +27-41-504 2394
Cell: +27 785147492

Appendix 2

Questionnaire 1 (Service providers/Designers)

Introduction

My name is Kevin Okolie, a PhD candidate at the Department of Construction Management Nelson Mandela Metropolitan University Port Elizabeth South Africa. I am researching on "Performance of Evaluation of Buildings in Educational Institutions: A Case of Universities in South East Nigeria". I am presently conducting a survey to assess how well buildings perform for those who occupy them after completion.

This information will be used to evaluate or assess areas that need improvement; provide feedback for the procurement of similar buildings in the future and to help the construction industry in general to better manage the environment**.** Please note that all information obtained from you will be treated confidentially and only used in aggregate for academic purposes**.**

Please kindly spare part of your valuable time to fill in the following questionnaire based on your experience.

Section A: General information

Name.....

Position.....

Institution.....

Experience /Number of years employed by the institution.....

Telephone.....

Postal address.....

1. Gender (please circle)

(i) Male
(ii) Female

2. What types of buildings make up your institution's building stock for the last fifteen years? *Please enter figures in all that apply*

Type of building	**Estimated total number**
Residential	
Classroom/lecture buildings	
Office	
Workshops/warehouses	
Commercial	
Recreational	
Special buildings	

3. How many employees are in your department/unit?

Full time	Part time

4. Which of the following statements apply to your organisation in relation to ownership and management of the buildings? *Please tick*

My institution owns and manages the buildings for own use	
My institution owns the buildings for external letting	
My institution manages the buildings for use but does not own them	
Other (specify)	

Section B: Evaluation attitude

5. Have you been involved in a building evaluation*? Please tick* ☐ Yes ☐ No

6. Is an evaluation plan created for building procurement in your organisation? Yes ☐ ☐

7. If yes to question 6, is the evaluation plan related to the goals created before procurement? Yes ☐ No ☐

8. What type of building evaluations do you conduct in your organisation? *Please tick*

Evaluation type	Never	Not often	In 50% of cases	Often	Always
Inspections					
External observations					
Interviews with users					
Performance indicators					
Manual measurements					
Personal observations or walkthrough					
Sustainability indicators					

9. On a scale of 1 (Not important) to 5 (Very important), how important is to evaluate buildings? *Please circle. If you are not sure, insert "6" in the space provided.*

.

1	**2**	**3**	**4**	**5**	

10. Which of the following is more important to your organisation? *Please tick*

Result/outcome of building performance evaluation	
Process of building performance evaluation	
Both process and result of building performance evaluation	
Other (specify)	

11. Based on your answer to question 8, what technique or evaluation instrument do you use for the evaluation of your buildings? *Please tick*

Evaluation technique	Never	Not often	In 50% of cases	Often	Always
Automatic measurements					
Condition Surveys					
Focus group					
Follow-up goals					
Occupant/user satisfaction					

12. On a scale of 1 (Not important) to 5 (Very important) which aspects of the building ranks most necessary or critical to evaluations in your organisation? *Please circle or insert "6" if you are unsure.*

	Aspects / Issue	Unsure	Not important …….....Very important				
			1	2	3	4	5
	Functionality/Condition		1	2	3	4	5
	Accessibility		1	2	3	4	5
	Productivity		1	2	3	4	5
	Health and Safety		1	2	3	4	5
	Security		1	2	3	4	5
	Cost effectiveness		1	2	3	4	5
	Aesthetics		1	2	3	4	5
	Environmental concerns		1	2	3	4	5

13. Which of the following statements relating to the management and funding of buildings apply to your institution? *Please tick the relevant cells*

My institution inadequately funds building performance evaluation and management annual budget	
Operating funds are not spent in a manner that supports desired outcome by my department.	
My institution is making the right investment in our existing building infrastructure	
Users/occupants of our buildings are generally satisfied with the spaces and services provided	
Building department/physical planning unit is developing staff that can sustain excellence	

14. When are evaluations conducted in your organisation? *Please tick*

12 months after moving in by occupants/users	
Together with the briefing process	
6 months after moving in by occupants/users	
Evaluations are not conducted	
While the building is under construction	
2 years and above after moving in by occupants/users	

15. On a scale of 1 (strongly agree) to 5 (strongly disagree), to what extent do you agree with the following statements regarding the conduct of building performance evaluation in your organisation? *Please circle)***.**

Statements	**Unsure**	Strongly disagree…….....Strongly agree				
		1	2	3	4	5
Emphasis on building performance and user-value enhances design and organizational effectiveness		1	2	3	4	5
Funding of building performance evaluation is below best practice standards.		1	2	3	4	5
Building facilities that are not fit for purpose impact negatively on teaching and acquisition of knowledge.		1	2	3	4	5
Lack of critical performance indicators/mandates in building design impact significantly on user satisfaction		1	2	3	4	5
Inadequate building facilities and spaces for learning and teaching affect academic performance		1	2	3	4	5
Lack of effective feedback mechanism results in poor design and procurement of unsuitable buildings.		1	2	3	4	5
Buildings that are not adaptable and flexible do not respond to the demands of changing needs.		1	2	3	4	5
Level of perception and awareness of building performance evaluation impacts significantly on building improvement policies		1	2	3	4	5

16 Please rank in order of importance from 1 (Not important) to 5 (Very important) the benefits of building performance evaluation in your organisation? *Please tick and note the unsure option "6".*

Benefits	Unsure	Not important…….…….....Very important				
		1	2	3	4	5
Increased productivity		1	2	3	4	5
Feedback to design and construction process		1	2	3	4	5
Improved quality and efficiency at work		1	2	3	4	5
Improved financial result		1	2	3	4	5
Improved functional programme		1	2	3	4	5
Continuous improvement		1	2	3	4	5
Satisfied user		1	2	3	4	5

17. On a scale of 1 (strongly agree) to 5 (strongly disagree) how would you rank the following as factors/reasons for not conducting the evaluation of building performance in your organisation? *Please circle and note the unsure option "6".*

Reasons/factors	Unsure	Strongly disagree……..……...Strongly agree				
		1	2	3	4	5
Lack of planning and time		1	2	3	4	5
Lack of demand		1	2	3	4	5
Insufficient expertise		1	2	3	4	5
Value of evaluation is unclear		1	2	3	4	5
No one is willing to pay		1	2	3	4	5
Lack of evaluation methods		1	2	3	4	5
Unwillingness to undertake evaluations and lack of responsibility		1	2	3	4	5
Poorly adapted evaluation methods		1	2	3	4	5
Evaluation methods are difficult to manage		1	2	3	4	5
Sensitive information		1	2	3	4	5
Ethical and personal barriers		1	2	3	4	5

18 What suggestions would you propose to assist your institution to effectively improving the performance of buildings in your institution? Please use separate sheet if necessary.

Thank you very much for your time and patience

Appendix 3

Questionnaire 2 (Staff and students)

Introduction

My name is Kevin Okolie, a PhD candidate at the Department of Construction Management Nelson Mandela Metropolitan University Port Elizabeth South Africa. I am researching on "The performance of buildings in educational institutions: A case study of Universities in South East Nigeria". I am presently conducting a survey to assess how well buildings perform for those who occupy them after completion. This information will be used to evaluate or assess areas that need improvement, provide feedback for the procurement of similar buildings in the future and to help the construction industry in general to better manage the environment. Please note that all the information obtained from you will be treated confidentially and only used in aggregate for academic purposes.

Section A: General

Institution.....

Location of building/faculty.....

Date.....

1. Gender **(*Please circle)***
a Male b Female

2. Occupation **(*Please circle the relevant options or state in other*)**
a Lecturer b Student c Researcher d Administrative staff e Other

3. Are you employed or registered (if student) as: a Full time b Part time c other

4. How long have you been in the institution? (***Please circle)***
a 10 years and above b 5-10 years c; 2-5 years d; under 2 years

5. Please state on the average, how much time you spend in the following building spaces per week in your institution? (Please ***tick* or insert "6" if unsure. *If you are a student, assume during the semester period)***

Type of space		Unsure	Time spent (in hours)				
			0-8	9-15	16-24	25-32	More than 32
a	Office						
b	Lecture room/class						
c	Laboratory/workshop						
d	Library						
e	Hostel/Residence						
f	Spats and gym						
g	Auditorium						

6. On a scale of 1 (makes work/studies more difficult) to 5 (makes work/studies easier) how would you rate the spaces in question 4 in your institution **(*Please circle and note the unsure option "6")***

Type of space		Unsure	More difficult……Easier				
			1	2	3	4	5
a	Office		1	2	3	4	5
b	Lecture room/class		1	2	3	4	5
c	Laboratory/workshop		1	2	3	4	5
d	Library		1	2	3	4	5
e	Hostel/Residence		1	2	3	4	5
g	Spats and gym		1	2	3	4	5
h	Auditorium		1	2	3	4	5

Section B: General building/ environmental safety.

7. On a scale of 1 (Not significant) to 5 (Very significant) what aspects of the following in a building environment contribute to your feeling safe? (***Please circle and note the unsure option "6"***)

Aspects		Unsure	Not significant…….....Very significant				
			1	2	3	4	5
a	Access control to building		1	2	3	4	5
b	Presence of security personnel		1	2	3	4	5
c	Lighting		1	2	3	4	5
d	Spatial configuration/relatively large space		1	2	3	4	5
e	Access control to parts of the building		1	2	3	4	5
f	Both access control and security personnel presence		1	2	3	4	5

8a Please rate the following aspects of the building on a scale of 1 (not accessible) to 5 (very accessible) as described in the table below. (***Please circle and note the unsure option "6"***)

Aspects		Unsure	Not accessible…….....Very accessible				
			1	2	3	4	5
a	Accessibility into and around the building (Examples lifts, ramps, maps, way finding, lighting or other mobility impairment devices)		1	2	3	4	5
b	How clean is the building?	Unsure	Very dirty……Very clean				
			1	2	3	4	5

8b Please circle as it applies to you in the building (***note the unsure option "6")***

	Aspects	Unsure	Not significant.....Very significant				
			1	2	3	4	5
a	Effect of air quality on your work performance		1	2	3	4	5
b	Air freshness	Unsure	Stale……. .Fresh				
			1	2	3	4	5
c		Unsure	Uncomfortable……....Comfortable				
	Temperature comfort		1	2	3	4	5
d	Ventilation comfort		1	2	3	4	5
e	Discussion privacy and distraction from noise		1	2	3	4	5
f	Visual privacy		1	2	3	4	5
g	Artificial lighting comfort		1	2	3	4	5
h	Natural lighting comfort		1	2	3	4	5
		Unsure	Poor……Very good				
i	Room acoustics		1	2	3	4	5
j	Colour		1	2	3	4	5

9. How would you rate the following performance measures of the building and its environment**?** **(*Please note the unsure option "6")***

	Measures	Unsure	Dissatisfied.....Satisfied				
a	General level of satisfaction		1	2	3	4	5
		Unsure	Adequate.....Inadequate				
b	Fitness for purpose		1	2	3	4	5
c	Maintenance		1	2	3	4	5
d	Space needs met		1	2	3	4	5
e	Access to daylight		1	2	3	4	5
f	Sanitary spaces		1	2	3	4	5
g	General accessibility		1	2	3	4	5
h	Fire safety		1	2	3	4	5
i	Furnishings		1	2	3	4	5

10. General/Additional comments..... (*Please attach sheets)*

Appendix 4

To whom it may concern

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Invitation letter to focus group meeting

My name is Kevin Chuks Okolie, a PhD candidate at the Department of Construction Management, Faculty of Engineering, Built Environment and Information Technology of the Nelson Mandela Metropolitan University South Africa. I am conducting a study on " Performance Evaluation of Buildings in Educational Institutions: A Case of Universities in South East Nigeria".

I would like to invite you to a brief focus group discussion to be held at your institution. The purpose of the discussion is to obtain your opinion and experience on broad issues of user values/requirements relating to the performance of educational buildings in your institution. The discussion will take place on 20th June 2010...….....at.....10h30.
The venue is……..and I will ensure that there is something nice to drink and eat.

Please contact me, if for any reason you may not be able to participate on the following contacts:
Phone: +234(0)7036832715
Email: kevchuks@yahoo.com
Very warm regards
Kevin Okolie

Appendix 5

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Confirmation Letter to Participate in Focus Group Discussion

Thank you for agreeing to participate in the focus group meeting. Please call me if you have any questions about the location or discussion group on phone number +234(0)7036832715. The discussion will last approximately 90 minutes and will begin promptly at 10h30 am. Light refreshment will be served, so you should arrive early to get settled before the discussion begins.

Please come alone as anyone coming with you will not be able to participate in the discussions. This is because you were purposely selected to ensure that a representative variety of knowledgeable participants attend. If you will be unable to attend, I would greatly appreciate it if you could call me on the above telephone number right away so that we can find a replacement. Thanks again for your help and enjoy the discussion.

Sincerely

Kevin Okolie

Appendix 6

Focus Group Ground Rules (Moderator Guide)

Hello, my name is..... I welcome and thank you all for coming. As stated when you were invited to this meeting, we are going to discuss your needs / requirements and experiences in buildings used for educational purposes (teaching, learning and residential) in your institution**.**

Before we start, the following are the ground rules to assist the discussion to go smoothly:

- If you have a cell phone or beeper, could you please turn it off or onto meeting mode.
- This discussion will be audio taped. There are two reasons for this; first, so that the researcher can concentrate on listening to you rather than spending time to make notes; and secondly, so that those who are interested in the discussion but are not here can have a record of it.
- I would like to encourage everyone to speak openly. There is no right or wrong answers to issues we will be discussing. We are only interested in hearing your opinions. There are thousands of people who have the same opinion and if you don't speak up, they are not going to hear about it.
- It is important that only one person talks at a time. When more than one person speak at the same time it is difficult to understand the message.
- Finally, my role is to moderate the group. I am not an expert on the topic we are discussing and I don't have specific opinions on the issue we will be discussing. My job is to ask you questions listen to you and make sure that we stay on the topic.

Thank you.

Moderator

Appendix 7

Focus Group Questions

- **Design strengths and weaknesses**

1. What do you think is the greatest asset about the design of buildings and learning environment in your institution?
2. What would you change about the design of buildings and earning environment in the institution?

- **Enhancement of learning**

3. In which way have the buildings enhanced your learning (students)?
4. In which way have the buildings enhanced your teaching and students' learning (lecturers)?

- **Community centre**

5. To what degree and in what way do you feel your building reinforces the school as a community centre?

- **User/stakeholder involvement in design**

6. Were you or someone you know involved in any part of planning or design of the buildings in our institution?
7. If so, do you feel your input and the input of others were taken into account in the design? Health, security and comfort?
8. Are you comfortable with the indoor environment (in terms air quality, ventilation and natural day lighting) of the buildings in your institution?
9. Do you perceive your institution to be adequately safe and secure from intruders or other form of man-made hazards/human aggressors?

- **Resource development/ sustainability issues**

10. To what degree are you aware that the design and/or management of buildings in your institution consider energy conservation measures, recycled materials or other practices of environmental sustainability?

- **Adaptability/flexibility**

11. To what degree do you feel building facilities in your institution will be adaptable and flexible to change in the future?

- **General Questions**

12. Do the public and private areas relate well to one another?
13. Do building uses fit well with the types and uses of adjacent buildings?
14. Viewed from the outside, do the building parts integrate well with each other to form a pleasing appearance?
15. Is it clear, what various parts of the building might mean to visitors?
16. Are the exits and entrances easily accessible?
17. Are the exits appropriate from a safety point of view?
18. How pleasant is the experience when you move from the exterior of the building to the interior by means of the main entrance?
19. Are sufficient routes, pathways and passages provided to and around the buildings?
20. Are all the circulation routes understandable and convenient?
21. Are the locations of lecturers' offices accessible?
22. Do the learning spaces in the buildings suit an individual's thermal comfort?
23. Is the noise level in a typical learning space distracting?

Appendix 8

Focus Group Sign-out Sheet

Institution.....

Venue.....

Date.....Time.....

I understand and agree that all the ideas which I have suggested during this discussion and any/all embodiments thereof shall without any additional compensation be freely used or otherwise dealt with by the researcher as he may see fit for academic purposes. I will keep confidential all information discussed during this group discussion.

Name (Print)	Signature
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Appendix 9

Interview guide

Contact person.....
Institution.....
Phone No.....

To whom it may concern

Sir/madam
My name is Kevin, Chucks Okolie, a PhD research candidate at Nelson Mandela Metropolitan University, Port Elizabeth, South Africa. I am conducting a survey on "Performance Evaluation of Buildings in Educational Institutions: A Case of Universities in South East Nigeria" The aim of the survey is to determine the extent to which educational buildings meet/satisfy the needs of users/occupants.

The purpose of this interview is to obtain your opinion and experience on the performance and management of educational buildings in your institution as well as how they can be improved. The interview is estimated to last between 45 and 60 minutes. Let me assure you that the data obtained through this interview and any documentation from you will be treated confidentially and that no records kept will bear your institution's name. I would also like to seek your permission to record the interview using a tape recorder.

The questions are about your current practices and some key aspects of building performance evaluation.

1. What is your status and nature of department responsible for the operation or management of buildings in your institution?

2 Are you involved in the design, construction and management of buildings? Yes or No.

3 What are your key measures for judging the success of a new building project after a building is completed and occupied?

4 Do you conduct any form of building performance evaluation? If yes, please describe how you do it

5 Who do you think should carry out building performance evaluations?

6 What problems do you have in conducting building performance evaluation in your institution?

7 If there is no specific answer to 4 and 5; how do you incorporate experience with previous building projects in determining key aspects of current or future building projects?

8 Are there features that have been included in your buildings in the past few years to improve efficiency of building operations, indoor environmental quality and occupant satisfaction? If yes, briefly describe

9 Within the portfolio of buildings, what are your key indicators of how well a building is performing for users in your institution? Please list.

10 What benchmarks or assessment tools for measurement of building performance and occupant comfort/satisfaction are you aware of? Please list

11 Do you use any benchmarks such as guides, standards, codes or regulations? If yes, what benefits do they provide for your practice and organisation?

12 Have you received occupant/user complaints regarding your buildings? If yes, what are the most common areas of complaints?

- Temperature control.....common/rare/occasional
- Ventilation.....common/rare/occasional
- Aesthetics.....common/rare/occasional
- Air quality.....common/rare/occasional
- Security.....common/rare/occasional
- Health.....common/rare/occasional
- Other amenities (list).....common/rare/occasional

12. What suggestions do you have for improving the performance evaluation of buildings in your institution?

13. Is there any question you would like to ask me?

Thank you for sparing some time out of your busy schedule to make this meeting possible. I wish to also thank you for the insights I have gained from your rich experience which will help in compiling data for this research.