MAINTENANCE MANAGEMENT SOURCING PRACTICES AND THE CONDITION OF TERTIARY INSTITUTION BUILDINGS IN SOUTH-WEST, NIGERIA

By

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By

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I declare that this thesis represents my original work in the Department of Building, University of Lagos. It has not been accepted for any previous application for a higher degree or previously published by any other person.

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Faremi, Olajide Julius

October 2017

SUPERVISORS' ATTESTATION

We hereby certify that the work in this thesis titled: **"Maintenance Management Sourcing Practices and the Condition of Tertiary Institution Buildings in South-West, Nigeria"** was carried out under our supervision and that it is the original work of the researcher, Faremi Olajide Julius.

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DEDICATION

This thesis is dedicated to the Almighty God, the Alpha and the Omega, my refuge and strength, a very present help in times of distress (Psalm 46:1, KJV)

To my darling wife Olamide Elizabeth Faremi and my lovely kids Jethro-Patrick Eniola and Jeanne-Elisabeth Oluwaseyifunmi Faremi.

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LIST OF ABBREVATIONS

ACBMI= Perceived condition of building elements and services maintained using insourcing

ACBMO= Perceived condition of building elements and services maintained using outsourcing

BAI=Insourced building aesthetics elements

BAO=Outsourced building aesthetics elements

BEI=Insourced building environmental services

BEO=Outsourced building environmental services

BFI= Insourced building fabrics

BFO=Outsourced building fabrics

BSI=Insourced building services

BSO=Outsourced building services

E=expected quality of service

G=gap in service (P-E)

LS= Less significant

MLU= Mean level of use

MS= Most significant

N= Population size

NA= Number of questionnaires administered

NOI= Number of institutions

NR = Number of questionnaires retrieved

OU = Often used

P=perceived quality of service

PCBMI= Predicted condition of building elements and services maintained using insourcing

PCBMO = Predicted condition of building elements and services maintained using outsourcing practice.

RR= Response rate

S = Significant

SS = Sample size

SU = Sometimes used

W=dimension weight

WGS=weighted service gap score

ABSTRACT

The deplorable state of buildings in tertiary institutions across the country due to non-strategic maintenance processes poses a threat to the delivery of qualitative tertiary education in Nigeria. Although building maintenance activities can be executed using insourcing or/and outsourcing practice(s), each of the sourcing practices has its merits and demerits. Policy makers in tertiary institutions are therefore saddled with the responsibility of deploying building maintenance practices that support the implementation of effective building maintenance activities. The making of an appropriate decision on either to insource or outsource maintenance services in a tertiary institution is strategic in nature. This decision-making process is usually complex and constitutes a difficult task to decision-makers. This is because different sourcing option suits different scenarios. This study aims at developing a decision-support framework for building maintenance insourcing and outsourcing practices in tertiary institutions. It examines the extent to which the condition of buildings in tertiary institutions is influenced by the quality of insourced and outsourced maintenance practices. Through a cross-sectional survey approach, data were collected from maintenance staff and building users using two sets of self-administered questionnaires. The sample for the study comprises 43 maintenance managers, 165 maintenance technical staff, and 406 building users across South-West, Nigeria. Secondary data were sourced from the National Universities Commission and the National Board for Technical Education. The statistical tools employed for the analysis include mean scores, the relative influence index, Wilcoxon signed-rank test, Welch's test, principal component analysis and multiple linear regression. Results of the analysis indicate that there was no significant difference between the level of use of insourcing and outsourcing practices in tertiary institutions in South-West Nigeria. The results revealed the factors influencing decision to insource or outsource maintenance services in Universities and Polytechnics in South-West Nigeria. The results show that there was no significant difference between the perception of maintenance staff and building users on the condition of buildings in tertiary institutions with respect to the maintenance sourcing practices. Buildings maintained through outsourcing practice were found to be in better condition than buildings maintained using in-sourcing practice. The result shows that there was a significant relationship between the quality of maintenance services and the condition of buildings in the tertiary institutions. The study developed a decision-support framework to assist policymakers and maintenance managers on insourcing and outsourcing decisions-making for building maintenance services in tertiary institutions. The study concludes that insourcing and outsourcing maintenance practices were interchangeably used in executing building maintenance activities in tertiary institutions. The decision to insource building maintenance activities are influenced by strategic, management and technological factors while outsourcing decision are influenced by quality, strategic and management factors. There is a significant relationship between the condition of buildings and the quality of maintenance services. Hence, the condition of buildings can be predicted by the quality of maintenance services. The quality of outsourced maintenance services was better than those of insourced maintenance services. Policymakers in tertiary institutions should adopt the proposed maintenance sourcing decision-support framework as a tool for driving building maintenance sourcing practices.

Keywords: In-sourcing, Outsourcing, Tertiary Institutions, Buildings, Maintenance.

CHAPTER ONE

INTRODUCTION

1.1 Background to the study

The maintenance management of buildings and allied infrastructure is an integral aspect of the overall administrative responsibility for any organisation or institution. This is irrespective of the nature and scope of the core business activities of such organisation or institution. Ogunmakinde, Siyanbola and Akinola (2013) posit that it is impossible to have buildings that are maintenance-free. Adenuga, Odusami and Faremi (2007) observe that although a few things can be done at the design stage that would ultimately reduce the amount of maintenance work required at the operation and maintenance phase of buildings, building elements will nevertheless deteriorate over time relative to the nature and characteristics of construction materials, method of construction, age, environmental conditions, use and misuse, type of design, and the maintenance management system adopted for the building.

The condition of buildings and their associated services have an impact on the performance of students and staff in an educational facility (Marilyn, 2006; Smith, 2008; Hopland, 2012). Recent studies on the impact of school buildings on students' health (Baker & Bernstein, 2012) reveal that the condition of school buildings does not only affect the academic performance of students but also impacts their health and psychological well-being. Durán-Narucki (2008) posits that school buildings that are characterised by various forms of building defects have both physical and psychological consequences on all category of users. Therefore, for school buildings, including those at institutions of higher learning, to meet the requisite standards of comfort and safety for students, staff, visitors and indeed all users, it is essential that appropriate maintenance management sourcing strategies be deployed.

Maintenance management services can be procured via insourcing or outsourcing (Natukunda & Pitt, 2011). It is also possible to adopt both sourcing options in a co-sourcing or hybrid arrangement. Wong (2008) explains that insourcing refers to a situation where organisation provides services internally using own personnel, while outsourcing refers to the strategy of having third-party vendors provide services for a fee over a period of time. The decision to insource or outsource can, however, constitute a challenge, as it can ultimately affect the quality of maintenance services, the overall maintenance cost and speed of delivery (Faremi, Adenuga & John, 2013).

A typical public tertiary institution in Nigeria has a dedicated Maintenance Unit as part of the Works and Physical Planning Department. Over the years, however, in spite of the existence of this department, most of the buildings and infrastructure in the nation's tertiary institutions are in a state of disrepair which has undoubtedly hindered the delivery of quality tertiary education in the country (Edukugbo, 2013). Faremi and Adenuga (2012) opine that the condition and quality of buildings reflect public pride or indifference, the level of prosperity in the area, social values and behaviour, as well as the many influences that give a community its unique character. Therefore, well-maintained buildings are as important as properly designed curricula for the delivery of qualitative education in tertiary institutions.

Studies have been undertaken on the maintenance management of public institution buildings in Nigeria. Most of the studies identified inadequate funding for maintenance activities and mismanagement of the meagre funds available for the maintenance of infrastructure as the underlying factors responsible for the decay that has characterised many public facilities in Nigeria (Ekundayo & Ajayi 2009; Adenuga 2012; Abigo, Madgwick, Gidado & Okonji 2012). Despite the challenges of inadequate funding across tertiary institutions in Nigeria, the

management teams of tertiary institutions (public and private) have the responsibility of not only erecting new structures to cope with the ever-growing population of students and staff but also of maintaining existing and ageing buildings and infrastructure in their institutions. There is, therefore, the need for decision-makers in tertiary institutions to choose the most appropriate maintenance sourcing option that optimises cost, improves quality of service and efficiency, and meets the demands for greater accountability (Ikediashi, Ogunlana & Bowles 2012).

Meanwhile, decision-makers in many institutions tend to follow a trial and error approach in choosing between insourcing and outsourcing options for maintenance services, as there is lack of a comprehensive maintenance management framework to guide the decision-making process (Lateef, Khamidi, & Idrus, 2010). Building maintenance policymakers often adopt a maintenance practice that seems right at the time while they hope for a favourable outcome. This trial-and-error approach often results in an unpleasant experience (Faremi *et al*., 2013), hence the importance of this study to fill the identified gap. It is imperative to develop a systematic approach to assist maintenance policymakers in decision-making on the choice of the most appropriate sourcing option for any building maintenance service in an institution.

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1.2 Statement of the Research Problem

Investment in physical infrastructure and the provision of maintenance management services should be geared towards achieving the strategic objectives of an institution or organisation, especially the objective of value creation (Kamarazaly, 2007). Rawlinson (2006) asserts that the decision to insource or outsource an activity in any organisation has profound effects on the success or failure of such activity. Decision-makers sometimes find it difficult to decide between insourcing and outsourcing, owing to the strategic and complex nature of the

challenge. Jin, Chua, Ali and Alias (2012) note that it is usually challenging for the decision-maker to select the appropriate sourcing option based on general adaptation for any specific set of buildings or services, as different sourcing options suit different situations.

Studies exist on concepts of insourcing and outsourcing practices as management strategies for sourcing products and services across various management fields and industries. For example, Adenuga, Olufowobi and Raheem (2010), Kumar, Soni and Agnihotri (2013), and Evans and Delegge (2014) investigated strategies for achieving effective maintenance operations, focusing on the development of maintenance policies that can assist the in-house staff of the maintenance department of organisations and institutions in the delivery of improved building maintenance services. The studies proposed strategies for improving the traditional maintenance management practice of insourcing services through an emphasis on the structuring and restructuring of an insourced maintenance organisation or unit for effective service delivery.

Further studies exist in various management fields such as Information Technology (IT), Logistics, Manufacturing, and Supply Chain Management. In IT, for example, Hirschheim and Lacity (1997), Burdon and Bhalla (2005), Bergkvist (2008), and Stanimirovic (2013) researched extensively on the risks and benefits of outsourcing services and concluded that critical failures, service provider underperformance, financial performance, and loss of knowledge were the potential risks of outsourcing services. Consequently, the authors recommended that outsourcing requires that both the client organisation and its consultants carry out full strategic assessment and evaluation of the proposed outsourcing strategy. Such evaluation should focus on a number of critical success factors such as cost reduction, improved service quality, better customer satisfaction, internal processes efficiency and staff

development. In Manufacturing, Supply Chain Management and Logistics, Kremic, Tukel and Rom (2006), Hatonen (2008), Bolumole (2008), Tayntor (2009), Kratena (2010), Križman and Ogorelc (2010), Nyaboke, Amemba and Osoro (2013) examined the decision motives of the client organisations in taking the route of outsourcing. The authors concluded that the decision to outsource services is usually premised on financial/economic, performance, administrative, political and technological considerations.

However, despite the numerous studies on insourcing and outsourcing services, very few works actually attempt to outline a comprehensive process by which policymakers can be guided when making the decision to insource or outsource maintenance services. Building maintenance management literature on insourcing and outsourcing decision-making process are rare. The review of previous studies on maintenance management has shown that there is paucity of studies on the provision of decision support system for building maintenance insourcing and outsourcing practices. The problem of this study, therefore, is investigating the factors influencing the practices of insourcing and outsourcing maintenance services, and the extent to which the condition of buildings in tertiary institutions is influenced by the quality of maintenance services. The lack of a comprehensive decision-support process of insourcing and outsourcing maintenance services has over the years contributed to wasteful spending on maintenance services and ineffective maintenance solutions, thereby increasing the rate of deterioration and decay in tertiary institution buildings across the nation. Consequently, there is the need to develop a comprehensive decision-support framework that would assist maintenance management policymakers in tertiary institutions on insourcing and outsourcing maintenance services.

1.3 Research Questions

In view of the challenges encountered by institutions in the maintenance of buildings, this research is designed to address the following research questions:

1. What is the level of use of maintenance sourcing practices in the management of tertiary institution buildings in South-West, Nigeria?
2. What are the factors influencing the choice of maintenance sourcing practice in tertiary institutions in South-West, Nigeria?
3. What is the perceived quality of building maintenance services in tertiary institutions based on maintenance sourcing practices within the study area?
4. What is the perception of maintenance staff and building users on the condition of buildings in tertiary institutions based on the maintenance sourcing practices?
5. Which decision-support framework can assist policymakers in tertiary institutions on suitable sourcing practice(s) for building maintenance services?

1.4 Aim of the Study

The aim of this study is to investigate the extent to which insourcing and outsourcing maintenance practices influence the condition of buildings with a view to developing a decision-support framework that would assist policymakers in the practice of insourcing and outsourcing maintenance services in tertiary institutions in South-West, Nigeria.

1.5 Objectives of the Study

In order to achieve the aim of this study, the following objectives were established:

1. to assess the level of use of maintenance sourcing practices in the management of tertiary institutions' buildings in South-West Nigeria;

2. to evaluate factors influencing the decision to insource or outsource building maintenance in tertiary institutions in South-West Nigeria;
3. to assess the quality of insourced and outsourced building maintenance services in tertiary institutions within the study area;
4. to examine the perception of maintenance staff and building users on the condition of buildings in tertiary institutions maintained using insourcing and outsourcing maintenance practices;
5. to develop a decision-support framework that would assist tertiary institutions' policy makers in decision-making on building maintenance sourcing practices.

1.6 Research Hypotheses

The set of hypotheses postulated for this study are as follows:

Hypothesis 1: There is no significant difference between the level of use of insourcing and outsourcing practices in the maintenance management of tertiary institution buildings in South-West Nigeria.

Hypothesis 2: There is no significant difference in the factors influencing building maintenance sourcing decisions between the categories of tertiary institutions in South-West Nigeria.

- **Hypothesis 2a:** There is no significant difference in the factors influencing building maintenance insourcing decisions between Federal, State and Private Universities in South-west Nigeria.
- **Hypothesis 2b:** There is no significant difference in the factors influencing building maintenance outsourcing decisions between Federal, State and Private Universities in South-west Nigeria.

- **Hypothesis 2c:** There is no significant difference in the factors influencing building maintenance insourcing decisions between Federal, State and Private Polytechnics in South-West Nigeria.
- **Hypothesis 2d:** There is no significant difference in the factors influencing building maintenance outsourcing decisions between Federal, State and Private Polytechnics in South-West Nigeria.

Hypothesis 3: There is no significant difference between the expected and perceived quality of building maintenance services in tertiary institutions based on insourcing and outsourcing maintenance practices.

- **Hypothesis 3a:** There is no significant difference between the expected and perceived quality of insourced building maintenance services in tertiary institutions.
- **Hypothesis 3b:** There is no significant difference between the expected and perceived quality of outsourced building maintenance services in tertiary institutions.

Hypothesis 4: There is no significant difference between the preception of maintenance staff and building users on the condition of buildings maintained using insourcing and outsourcing practices.

- **Hypothesis 4a:** There is no significant difference between the perception of maintenance staff and building users on the condition of buildings maintained using insourced maintenance practices in tertiary institutions.
- **Hypothesis 4b:** There is no significant difference between the perception of maintenance staff and building users on the condition of buildings maintained using outsourced maintenance practices in tertiary institutions.

Hypothesis 5: The quality of maintenance services does not predict the condition of buildings in tertiary institutions in South-West Nigeria.

1.7 Significance of the Study

Taking an appropriate decision (i.e. outsourcing or insourcing) on maintenance services is a complex task, owing to factors such as subjectivity, non-linearity, and the existence of multiple criteria. Any decision taken also has to align with the business goals and corporate objectives of the concerned institution. It is therefore clear that this decision is indeed a strategic one. The present study is a holistic investigation of sourcing decisions routes (insourcing and outsourcing) for maintenance services. It is expected that it would help to: solve the problem of 'best' sourcing route for maintenance services in tertiary institutions; incorporate the influential factors on sourcing decisions; highlight the economic and social benefits that could accrue to well-maintained tertiary institution buildings; and provide the basis for evaluating the quality of maintenance service delivery in tertiary institutions.

This study would be of benefit to the Federal Government of Nigeria, the National Universities Commission and the National Board for Technical Education, as the study offers a comprehensive process for choosing the best maintenance sourcing routes for each maintenance activity. The choice of the most appropriate maintenance practice would enhance maintenance cost reduction, improve the condition of buildings in tertiary institutions and prolong the service life of building elements and services in tertiary institutions. It will reduce the rate of deterioration of building elements and services, thereby preserving the huge investment committed to building stock in tertiary institutions and improving the return on investment.

This study offers the management teams and maintenance managers of tertiary institutions a guideline for scoping maintenance activities. Maintenance managers can adopt the proposed maintenance activities categories of building fabrics, building services, building

environmental services and building aesthetics services in defining the scope of maintenance services in their tertiary institutions. The study equally provides policymakers in tertiary institutions with a solution to the challenge posed by the existence of multiple criteria in taking insourcing and outsourcing decisions. The significant sourcing decision factors established by this study will assist policymakers in tertiary institutions to assess the maintenance services to be considered for insourcing and outsourcing. Furthermore, key quality indicators established by this study would assist policymakers in tertiary institutions to evaluate the quality of maintenance services delivered through insourcing and outsourcing maintenance practices. The decision support framework would further assist them to make informed decisions in the areas of maintenance management insourcing or outsourcing, with a view to improving the quality of building maintenance services in tertiary institutions. In addition, by the results of this study, the top management and policymakers of tertiary institutions are exposed to significant factors that should be considered when making the decision either to keep maintenance services in-house or to outsource them.

Furthermore, this study provides contracting firms and vendors in maintenance services outsourcing in tertiary institutions with indicators of the expected quality of maintenance services to be achieved when undertaking outsourced maintenance services in tertiary institutions in South-West Nigeria. The resulting framework from this study provides stakeholders in the maintenance management of tertiary institution buildings with the processes for evaluating the quality of building maintenance services and for conducting building condition assessment. Finally, the study is also an insightful addition to the literature on maintenance management, especially with regard to insourcing and outsourcing services.

1.8 Scope and Delimitation of the Study

This study is delimited to Southwest Nigeria comprising Lagos, Ogun, Oyo, Ondo, Osun, and Ekiti states. It focuses on maintenance insourcing and outsourcing practices in tertiary institutions within the region. The study sampled only Universities and Polytechnics duly licensed for operation by the National Universities Commission and the National Board for Technical Education, respectively. Thus, a total of 29 Universities and 14 Polytechnics were sampled in the identified geographical area.

The population of this study comprised public and private universities and polytechnics within the study area. The sampling frame comprises maintenance staff and users of tertiary institution buildings. The former are personnel involved in tactical and strategic maintenance services and were considered as the suitable respondents for management and technical issues, while the latter comprised academic staff, administrative staff and students of tertiary institutions within the study area. These constitute the sample that assessed the quality of maintenance services in tertiary institutions within the study area. This study excluded all Colleges of Education within the study area.

1.9 Operational Definition of Terms

Building: An aggregation of all the elements of the building fabric and associated services including but not limited to electrical and mechanical installations, lawns and gardens, walkways and parks etc., which supports the building and contribute to the physical and functional status of the building.

Building Maintenance: All activities that are undertaken to preserve or restore building elements and services in good physical and functional state.

Client: Individual, Institution or Corporate organization that engages service providers for outsourced maintenance service.

Insourcing: The execution of maintenance services through personnel that is fully engaged as the staff of the institution on a full-time basis.

Maintenance: Work done to keep or restore a building to an acceptable standard.

Maintenance Practice: This refers to the approach or process by which maintenance activities are carried out in tertiary institutions.

Outsourcing: The delegation of maintenance services totally or partially to another company along with part of the administrative and operational control.

Outsourced Firm/Service Provider's Firms: Firms contracted to undertake outsourced maintenance service.

Planned maintenance: Is a maintenance that is being organized and carried out with forethought, control and the record to a predetermined plan.

Quality of service: Refers to the perceived level of satisfaction that the client(s) or user(s) of the building(s) derived from building maintenance services.

Replacement: a remedial measure of maintenance arising from the deterioration of elements [especially in appearance].

Sourcing: This is interchangeably used with procurement in this study and it refers to the approach by which maintenance personnel are engaged to carry out maintenance services.

The condition of Building: This refers to the perceived physical and functional state of the components and elements of buildings and associated services within the study area. It is interchangeably used in this study with operational state and maintenance state of buildings.

Users: This refers to the people making use of buildings and associated services; the group comprises of all non-maintenance staff. This group of people include such people as academic staff, administrative staff, technical staff, and students but excludes staff of maintenance department both of the tertiary institution and of the outsourced vendors. They are people with foreknowledge of the building.

Vendor: This refers to an organization or corporate entity contracted to provide maintenance services on an outsourced basis.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The purpose of this chapter is to identify and review relevant literature on insourcing and outsourcing practices in maintenance management. In addition to insourcing and outsourcing, the review also focuses on the physical and functional conditions of buildings, the quality of services rendered across the various maintenance activities, as well as general maintenance management practice. Furthermore, the chapter discusses the theoretical and conceptual framework for the study, offering a framework within which to understand the basic concepts of building maintenance, the theory of insourcing and outsourcing services as management strategies, the theory of service quality, as well as the condition of building systems and services.

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2.2 The Concept of Insourcing and Outsourcing Services

Faremi *et al.* (2013) note that the decision to source maintenance or facilities management services can be made through insourcing, outsourcing or a combination of both. According to Atkin and Brooks (2009), the approach taken depends on the priority set by the organisation for the services to be procured. Insourcing, or the in-house option of procuring maintenance services, is a form of service provision in which maintenance services are provided by a dedicated resource directly employed by the client organisation, where monitoring and control of performance is normally conducted under the terms of the conventional employer-employee relationship, although internal service-level agreements may be employed as regulating mechanisms (Kamarazaly, 2007).. APSE (2011) posits that insourcing emerged as a means of delivering efficiency and ensuring savings in the face of mounting budgetary pressure.

However, Goure (2011) argues that the expectations of efficiency and cost savings through insourcing public projects are seldom met.

On the other hand, outsourcing resulted from an economic climate where the emphasis is on cost savings and increased profits occurring together with increased quality (especially for lean operations). Faced with intense global competition, operational risks, limited resources and new technologies, companies and organisations try to optimise their resource allocation and there are increasing numbers of companies and organisations who would like to outsource their 'non-core' activities in order to reduce the risk of the operation. These are activities where the risk of losing know-how by outsourcing them is low. In other words, outsourcing is another approach leading to greater competitiveness (Ikediashi *et al*., 2012). This is achieved by concentrating on companies' core competencies and outsourcing all activities for which the company has neither a strategic need nor a special capability, thus resulting in increased returns on internal resources.

Brown and Fersht (2014) state that outsourcing is the act of obtaining services from an external source. Dawne (2011) explains that the guiding principle of outsourcing is that non-core and even critical activities of an enterprise or organisation could be handed over to companies with lower labour costs and with expertise in those activities, thereby freeing internal resources to focus on enhancing the value added of the organisation's core business. It can, therefore, be said that outsourcing is a process where firms assign some of their in-house tasks/activities or processes to a third-party vendor. Outsourcing is a form of transaction or contract. Often times one company or organisation purchase service(s) from another while keeping the ownership and eventual responsibility for the processes. Organisations employ this method to contract or

hire an external agency, vendor or individual to perform a service or operation rather than utilising internal staff to do the same work.

Bajec and Jakomin (2010) explain further that subcontracting and, more generally, productive outsourcing have diffused in all industrialised countries in the last three decades. Attention to this phenomenon arose in the field of organised vertical markets in which vertical co-ordination by large firms has been progressively substituted by a decentralised network of suppliers, governed by principles of lean production and just-in-time. Outsourcing has also been the more significant source of downsizing in local systems of small firms, implying that small firms remain small. The result has been the growth in informative and strategic inter-dependency among firms, with numerous implications ranging from the fragmentation of labour markets to the intensified use of information technology.

Organisations in various fields turned to outsourcing for numerous reasons, hoping to meet their multiple needs. According to Hayes (2004), whether the goal is to reduce costs or to obtain expertise, to offer help-desk operations or application maintenance, outsourcing has become a major feature of modern business. A typical outsourcing agreement might last for a number of years, governed by a contract setting the terms and conditions between the client and outsourcer for the duration of their relationship. Embleton and Wright (1998) observe, however, that none of the outsourcing definitions deals with the issue of timing of switching from in-house to "external sourcing" (outsourcing), or with the identification of functions that could be outsourced. In fact, once a company's readiness to outsource has been established, the next step is for those operational functions and activities that offer the most potential to be identified. These usually support services that are not part of the organisation's core competencies. Support services are routine, well-defined, can be measured and managed "at

arm's length" and are provided by the suppliers in the marketplace, in a competitive atmosphere which may include services that are critical and specialized (Campbell, 1995).

Iyagba (2005) argues that outsourcing holds the promise of flexibility and profitability even though there may be not so obvious disadvantages. Iyagba (2005) noted that outsourcing allows a firm to focus on its core business and competencies, leaving peripheral and support functions to outside experts. According to Iyagba (2005), for smaller employers, outsourcing also has the advantage of helping to reduce numbers, possibly removing the business from the statutory threshold of increased obligations, including submission of employment equity plans. Iyagba (2005) adds that a business must consider the potential downsides to outsourcing. First, the firm must engage only reputable service providers with a proven track record of compliance and good human relations. Second, where outsourcing involves the dismissal of redundant staff, this may contribute to the country's chronic unemployment problem.

Third, there is still uncertainty in legal circles over whether, and under what circumstances, outsourcing constitutes a transfer of a business as a going concern; therefore, in using outsourcing good legal advice should be obtained. Fourth, employers sometimes outsource non-core functions to existing staff with the idea that they would become entrepreneurs by supplying expertise back to the old employer as independent contractors. A fifth problem is that the introduction of a service provider in the form of a labour broker may upset established relations and create friction between the employer's own employees and those of the service provider. Another less obvious problem is the fact that long-term exclusive outsourcing arrangements create a dependency that might isolate the organisation from the market. According to the author, by giving the vendor the exclusive right to understand one's business, one may be making it harder in the longer term to terminate the relationship. The vendor may,

in turn, build up relationships with the business peers and partners and become a surrogate in dealing with them. Therefore, unless the rules are clearly spelt out and the business makes an effort to maintain its visibility, there is a real risk of its relationships with them disappearing.

Generally, while outsourcing offers potential benefits in terms of cost, service levels and access to talent, it is a strategic decision requiring careful thought about risks, benefits, and governance. Some of the risks associated with outsourcing include: inability of outsourcing vendor to deal with volume of activities, variance in work ethic between organization and outsourcing vendor, inability of outsourcing vendor to perform task within specified time, inadequate contract performance measures and penalties, lack of capability to deal with time management when associating with outsourcing vendor, lack of flexibility and contract solely focusing on cost-cutting issues (Kamarazaly, 2007). Therefore, it is unlikely that outsourcing will prove desirable to dispense with in a service labour organisation since there are many benefits in employing a small group of craftsmen directly, particularly if they are multi-skilled. Such benefits include familiarity with the assets, understanding how the assets operate, being aware of the maintenance requirements, quick response time in emergencies, enhancing security, and presence of personal commitment and loyalty to the institution. But disadvantages also exist with regard to having an in-house team. Top management has to ensure that there is sufficient work to consistently engage the workforce; otherwise, they will be redundant and will only be draining the organisation's resources.

No doubt, outsourcing of one or more maintenance services may be associated with some difficulties, such as employee-related issues, loss of skills and lack of the internal expertise to manage outsourcing contracts and potential loss of control. On the other hand, outsourcing

may result in cost savings, improved quality and the transfer of knowledge from outside specialists to internal personnel (Adenuga, 2008).

2.3 Level of Use of Insourcing and Outsourcing Practices

The execution of maintenance works is the practical realisation of all the management decisions, designs, and dreams for maximising the results of maintenance efforts. According to Adenuga (2010), maintenance works are complex and therefore require being done by directly employed labour as well as by contractors. The proportion of maintenance services that are insourced or outsourced is dependent on an organisation's policy and it is the maintenance policy of the institution or organisation that dictates whether directly employed labour or contractors or both will be most advantageous in executing maintenance activities for any given services (Adenuga & Dosumu, 2012).

Aubert and Weber (2001) reveal that out of 40 and 21 Information Technology firms in the United States of America and the United Kingdom respectively, 14 of them sourced their services through total outsourcing, 15 adopted total insourcing for carrying out various services within their organisations while the remaining outsourced part of their services and retained part in-house in a hybrid sourcing arrangement. Ikediashi *et al* (2012) suggests that in order to ascertain the level of maintenance services to be outsourced, the statistics of interest should comprise the number of services to be outsourced, range of contract value, contract duration, number of staff to be transferred and the level of officer(s) supervising the contract. The present study seeks to assess the extent to which maintenance services are either outsourced or insourced in tertiary institutions within the study area.

2.4 Factors Influencing the Decision to Insource or Outsource Maintenance Services

Traditionally, the decision to either insource or outsource maintenance services in an organisation or institution emanates from the ability of the client to define maintenance requirements and the ability to relate asset performance to maintenance effectiveness. Sang (2010) opines that in reaching a decision to insource or outsource services, the maintenance manager should compare the costs and quality of providing services in-house (i.e. with his own directly employed labour) against having the services provided by prospective outsourced vendors.

In quantitative terms, Dawne (2011) highlights the factors influencing decisions to insource services, viz: timing and coordination of activities, reputation of institution (which could be damaged by vendor's action), activities viewed as core to the institution, difficulty in finding vendor with a compatible organisational culture, the likelihood of a subcontractor acting in their own interest to the detriment of the institution, difficulty in finding trustworthy vendors, the fact that economies of scale can be achieved in-house, difficulty in contracting for unpredictable activities, difficulty in appraising vendor's performance, and the likelihood of a vendor feeling exposed to potential loss of investment.

The decision to outsource depends on a number of factors. The motive for outsourcing (Kremic *et al*., 2006) absolutely non-core activities is in most cases different from that for activities closer to the core of an organisation's business. Different organisations in different circumstances will expect different benefits. Stanimirovic (2013) identifies five main reasons why companies outsource as: to focus resources on core activities, to achieve cost reduction, to convert fixed costs to variables, to benefit from a supplier's investment, and to innovate and improve time to market. Similarly, Assaf, Hassanain, Al-Hammad, and Al-Nehmi (2011)

discuss thirty-eight (38) factors influencing the decision to outsource maintenance services. These factors were grouped into six major categories: strategic factors, economic factors, management factors, technological factors, function characteristics, and quality factors.

Comparatively, Jin, Chua, Ali and Alias (2014) assert that in making the decision to insource or outsource maintenance services, the importance of a number of factors has to be ascertained. The recommended factors include execution speed, time certainty, price or cost certainty, degree of complexity, degree of flexibility, responsibility, risk allocation or avoidance, quality level, working relationship, clarity of scope, intuition and past experience of the decision-maker, dissatisfaction with previous processes used, knowledge of the strategy, client's involvement in the project, existing building condition, size of the building, client's in-house technical capability, client's financial capability, the external environment and factor, price competition, public accountability, culture, objective or policy of organisation, government policy, dispute and arbitration, and availability of experienced contractor.

This study examines all the motives for insourcing and outsourcing decisions as presented in the various works reviewed for this study, with a view to determining those that are peculiar in influencing the decision of policymakers of tertiary institutions within the study area, thus contributing to the existing body of knowledge.

2.5 Quality of Maintenance Services

Idrus *et al*. (2009) posit that effective building maintenance is required for a building to function optimally over its entire lifecycle. They suggest that the value of a building, from its users' perspective, can be viewed as the measure of how efficiently and effectively the building meets the users' needs with the available resources. Toossi (2011) explains that the level at

which users of buildings are satisfied with maintenance services can be measured by assessing performance on safety precautions during maintenance works, the time taken to execute maintenance work, quality of work as well as the level of satisfaction with the elements of the building fabrics. However, a standard model known as the Service Quality (SERVQUAL) model exists in the literature and is widely used across disciplines for measuring service quality.

SERVQUAL has been heavily debated in the literature (Singh & Khanduja, 2010) because of difficulties in defining and measuring it. SERVQUAL has been most commonly conceived as having to do with the extent to which a service meets customers' needs or expectations (Daniel & Berinyuy, 2010; Manani, Nyaoga, Bosire, Ombati, & Kongere, 2013; Adat & Noel, 2014). SERVQUAL can thus be defined as the difference between customer expectations of service and perceived service (Singh & Khanduja, 2010; Adat & Noel, 2014). This implies that if customers' expectations are greater than service providers' performance, then quality is less than satisfactory and hence customer dissatisfaction occurs (Parasuraman, 1988).

In this study, SERVQUAL is defined as the difference between tertiary institution building users' expectation of performance for maintenance services prior to the service encounter and their perception of the service received afterwards. Building users' expectations are a foundation for evaluating maintenance since quality is perceived to be high when performance exceeds the expectation of those receiving the service (Krajňáková, Navikaite, & Navickas, 2015). Meanwhile, perceived quality is low when performance does not meet their expectations. In the SERVQUAL literature, the expectation is seen as the desires or wants of a recipient of a particular service, i.e. what the receiver of a service feels a service provider should offer rather than what is being offered by the service provider (Parasuraman, 1988).

Singh and Khanduja (2010) explain that the perceived service is the outcome of the user's view of the service dimensions, which are both technical and functional in nature. The user's total perception of a service is based on their perception of the outcome and the process; the outcome is either value added or quality and the process is the role undertaken by the user (Daniel & Berinyuy, 2010).

In addition, perceived quality can be defined as a form of attitude that is related but not equal to satisfaction and that results from a difference between expectations and perceptions of performance (Parasuraman, 1988). Therefore, having a better understanding of users' attitudes will help know how they perceive service quality in maintenance service delivery in tertiary institutions. SERVQUAL represents the discrepancy between service receivers' expectations for a service offering and the service receivers' perceptions of the service received.

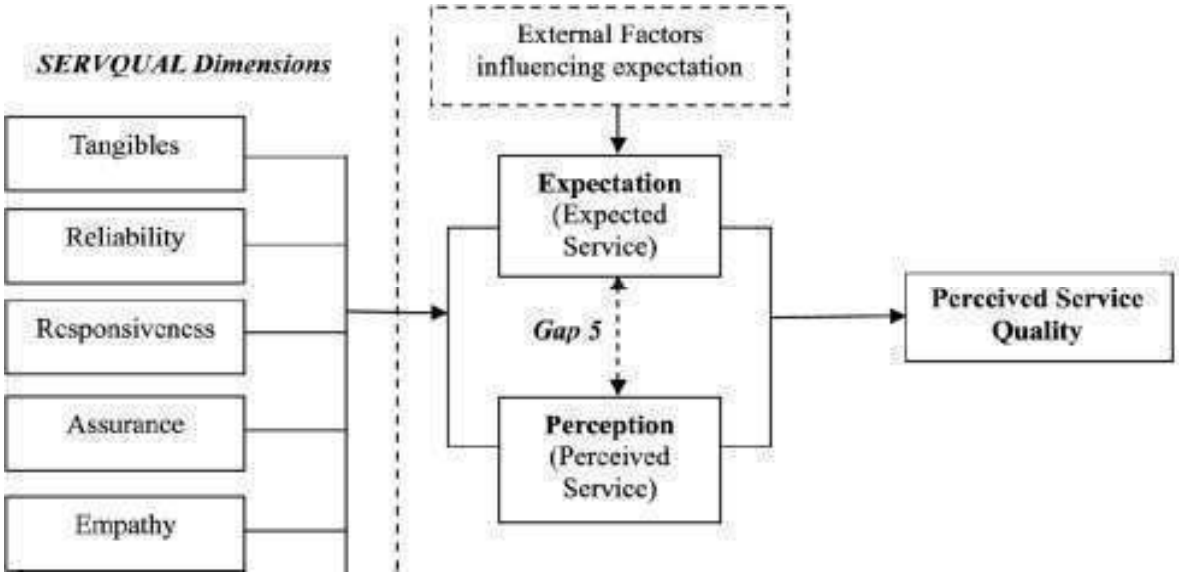

Figure 2.1 Measuring service quality using the SERVQUAL model (Daniel & Berinyuy, 2010)

The use of 'perceived' as opposed to 'actual' service received makes SERVQUAL a measure that is related to, but not the same as, satisfaction (Parasuraman, 1988). The difference between

expectations and perceptions is known as the gap, which is the determinant of the service receivers' perception of service quality, as shown in Figure 2.1.

The expectations of those receiving service are subject to external factors that are under the control of the service provider, as shown in the diagram. Gap 5 in the diagram represents the difference between service receivers' expectations and service receivers' perceptions, which is described as the perceived service quality (Singh & Khanduja, 2010). This study focuses on this gap, i.e. the difference between the expectations of users of tertiary institution buildings on the delivery of maintenance services and their perceptions of maintenance service delivery by the maintenance unit. A total of 22 items have been developed as measures for evaluating the five service quality dimensions (Adil, Ghaswyneh & Albkour, 2013). Table 2.1 shows the service quality dimensions and their corresponding measures as adopted for this study.

Table 2.1: Service quality dimensions and their corresponding measures

Service Dimension	**Quality of Service Measure**
Tangibility (Physical facilities, equipment, staff appearance, etc.)	Modern and functional equipment
	Visually appealing physical facilities
	Professional appearance of maintenance staff
	Quality and visually appealing materials
Reliability (ability to perform service dependably and accurately)	Act according to promises
	Sincere interest in solving problems
	Services are performed right the first time
	Provide services at the time promised
	Keeps error-free records

Service Dimension	Quality of Service Measure
Responsiveness (willingness to help and respond to customer need)	Informs building users exactly when maintenance services will be provided. Provides prompt services. Always willing to help. Never too busy to respond to service requests.
Assurance (ability of maintenance staff to inspire confidence and trust)	Employee behaviour instils confidence. Building users feel secure in their transactions. Employees are consistently courteous. Employees have the knowledge to answer questions.
Empathy (the extent to which caring individualised service is given)	Provides individual attention. Has convenient operating hours. Employees provide personal attention. Has the best interest of the building users at heart. Employees understand the needs of building users.

Adapted from Gibson (2009).

Table 2.1 shows the five SERVQUAL dimensions and the 22 items of measuring them. For this study, the 22 items of SERVQUAL were adopted in order to determine the extent to which the maintenance sourcing practices satisfy the service dimensions in the delivery of maintenance services in tertiary institutions in South-West Nigeria.

2.6 Overview of Condition of Buildings

The physical and functional state of a building is the major feature by which its condition can be evaluated. Adenuga and Dosumu (2012), in a study of the assessment of procurement methods used for maintenance works of buildings, found that only 27% of surveyed respondents perceived their buildings as being in very good condition. Once they have been completed, buildings are generally expected to perform certain functions for a certain period. However, a building must be maintained to keep it in optimal operation since it is impossible to have maintenance-free buildings (Ajetomobi & Olanrewaju, 2015). In fact, the physical and functional condition of any building is a reflection of the amount of maintenance attention given to it. Lateef, Khamidi, and Idrus (2010) assert that a building is an asset whose value changes in accordance with the quality and quantity of maintenance activities invested in it. The essence of building maintenance is, therefore, to increase the service life of a building by delaying deterioration, decay, and failure.

Building maintenance must, therefore, be considered as a strategic process if the value of a building is to be sustained (Idrus, Khamidi & Lateef, 2009). It has thus been established in the literature that for optimum performance in tertiary institutions, functional assets are required. Waziri and Vanduhe (2013) observe that both public and private buildings in Nigeria are faced with neglect owing to lack of maintenance, which in turn results in a rapid rate of defects, deterioration, and failure in some cases. Adenuga (2012) presents a comprehensive list of various building elements and maintenance services that are required for keeping a building well maintained: building fabrics, services, environment, and aesthetic. This study adopts the list of maintenance services as presented by the authors of reviewed literature to evaluate the operational state of buildings in tertiary institutions in South-West Nigeria.

2.7 Maintenance Management of Buildings

Building maintenance can be defined as the process by which a building is kept usable at a predetermined standard for the use and benefit of its occupants or users (Mydin, Ismail & Ulang, 2012). For buildings in tertiary institutions, Lateef, Khamidi and Idrus (2011) state that maintenance focuses on building care and can thus be said to be the required processes and services undertaken to preserve, protect, enhance and care for tertiary institution buildings' fabric and services after completion, in accordance with the prevailing standards to enable the building and services to perform their intended functions throughout their lifespan without drastically upsetting their basic features and uses.

Mydin, Ismail and Ulang (2012) report that investment in building maintenance is usually massive throughout the world, as it gulps approximately 50% of the entire revenue of the construction industry in most countries. Lateef, Khamidi, and Idrus (2011) found that the assets of tertiary institutions comprise funds, technology, human resources, equipment and plant as well as constructed facilities (i.e. buildings). Clearly, tertiary education is labour-intensive and the human resource is its most significant asset, but the human resource needs buildings to function effectively. It is, therefore, no wonder that buildings may sometimes constitute up to 90% of a tertiary institution's assets. Generally, buildings are essential assets to institutions, organisations and the nation at large, as they provide people with the shelter and facilities that support the carrying out of daily activities.

However, buildings deteriorate and dilapidate during their service lives since their components and systems suffer wear and tear underuse and associated external factors. It is therefore critical that for a building to be functional and perform efficiently, a building maintenance system has to be in place (Jin *et al*., 2012). Lateef, Khamidi, and Idrus (2011) have thus noted

that building maintenance impacts everyone's life because the comfort and productivity of building users are relative to the performance of the building in which they live and work. In the case of tertiary institution buildings, how effectively users learn, conduct research and work is often a function of building conditions.

Waziri and Vanduhe (2013) view building maintenance as an important programme for the sustainability of infrastructural development, since building maintenance supports building facilities to retain their structural, functional and aesthetic conditions throughout their lifespan and reduce unnecessary expenditure. All buildings, including those of tertiary institutions, require maintenance in order to create an environment that is capable of supporting and stimulating learning, teaching, innovation, and research. It is therefore clear (Olanrewaju Abdul Lateef et al., 2010) that the prime objective of maintenance is to ensure, as far as practicable, the continued peak performance of the building throughout its useful life. Therefore, as the systems, components, and elements of a building begin to deteriorate, it becomes necessary for proactive and reactive measures to be taken in ensuring that the desired physical and functional characteristics of a building which provides safety and convenience are preserved.

Maintenance of the built environment no doubt impacts the whole nation, as the conditions of the surroundings in which we live and learn are a reflection of the nation's well-being. As Adenuga (2010) observes, "The condition and quality of buildings reflect public pride or indifference, the level of prosperity in the area, social values and behaviour and all the many influences both past and present which combine to give a community its unique character." An effective maintenance management system might be characterised as the product of prudence, in the reflection of the saying that a stitch in time saves nine. Choka (2012) argues

that good maintenance management systems are essential for economically viable and operationally safe buildings. It is to be noted that maintenance management practice across the nation's tertiary institutions has suffered from lack of funds for a considerable period of time. While the requirements for good practice in maintenance management of building stock have been established over a considerable period, the achievement of good practice is by no means universal (Ajetomobi & Olanrewaju, 2015).

Amusan *et al*. (2014) assert that the maintainability of buildings is one of the key areas in which the construction industry must achieve significant improvement. However, maintainability is generally given little attention over the life of the building. According to Adenuga *et al*. (2007), while it is impossible to produce buildings which are maintenance-free, maintenance work can be minimised by good design and proper workmanship carried out by skilled experts or competent craftsmen using suitable codes of installation, requisite building materials, and methods.

The management of any process involves assessing performance, and maintenance management of buildings is no exception. In order for any maintenance manager to measure performance and set priorities, an organisation's needs first have to be considered, that is, the function and performance of buildings and their appropriate standards will be independent of users' perception and their primary needs (Eghan, 2014). The performance of tertiary institution buildings and their components depends mainly on continuous and planned periodic maintenance, a situation which challenges institutions' management teams and facility managers to institute precise planning based on well-structured maintenance programmes (Faremi & Adenuga, 2012). Despite the ever-growing need for lower operational costs,

facilities managers must ensure that facilities are constructed and maintained without compromising safety.

The colonial architecture of some of the older institution buildings especially in the earliest universities and polytechnics, which was hitherto famous for its sturdiness and functionality, has now become less attractive because of the general neglect of the buildings. If the deterioration is not checked, all these old buildings and facilities will decay and will only be replaced in function if the means are available. The inadequacy of the operation and maintenance of buildings and infrastructure in a developing country has serious consequences for economic and social development.

While Faremi and Adenuga (2012) concede that it is highly desirable but hardly feasible to produce maintenance-free buildings, much can be done at the design stage to reduce the amount of subsequent maintenance work. All elements of buildings deteriorate to some degree, depending on materials, the method of construction, age, environmental conditions, usage of the building, and method of design and maintenance management of the building. Therefore maintenance is war: The enemies are the triumvirate of breakdown, deterioration and all types of unplanned events, while the soldiers are the maintenance departments in organisations as well as the many civilians as we can recruit (Adenuga et al., 2010). Thus, as military historians study battles with an eye towards identifying the pattern of conditions that dominated the outcome, so do maintenance managers have many strategies and weapons at their disposal – some new, some old, some complex, some simple, some defective at one theatre of operation and some better at another. Each adopted strategy will work only with the support of the correct weapons and logistics.

In summary, maintenance management is the sum total of all activities undertaken to achieve the goals and objectives of an institution or organisation. It is simultaneously the integration of effort, the design of organisational structure, the acquisition and judicious use of maintenance resources, motivating people, providing leadership, planning strategies, controlling, innovating and creating an environment in which the maintenance goals of the organisation can be achieved. This study draws support from the existing literature in investigating maintenance management sourcing practices in tertiary institutions in South-West Nigeria.

2.8 Theoretical Framework

A theory is a set of interrelated constructs (variables or questions) that present a systematic view of phenomena (Naoum, 2012) by specifying relationships among variables for the purpose of explaining natural phenomena. Lee, Huynh, Chi-wai & Pi, (2000) define a theory as a systematically related set of statements, including some law-like generalisations that are empirically testable. Similarly, Bhattacheherjee (2012) maintains that a theory is a framework for an entire study, an organising model from the research questions and the data collection procedure. These definitions justify the need for a robust theoretical framework for any given study. This section, therefore, reviews existing theories underlying the study of insourcing/outsourcing practices as well as decision-making and quality of service with a view to establishing the basis for the development of a conceptual framework for the study.

This study focuses on how management teams decide on whether to insource or outsource maintenance services in tertiary institutions and the extent to which the adopted sourcing option impacts the quality of maintenance services and, consequently, the conditions of buildings as perceived by their users. Therefore, there is need to review theories on insourcing

and outsourcing services, as well as those on rational decision-making and post-adoption satisfaction of maintenance management services delivery based on insourcing and outsourcing practices.

Bergkvist (2008) states that the most common economic decision reference theory is the Transaction Cost (TC) theory. Ventovuori (2007) affirms that the most common theoretical approach to a make-or-buy decision is the Transaction Cost Economics (TCE) (Williamson, 2007). The TCE attempts to describe transactions by using three dimensions (Williamson, 1981): the extent and form of asset specificity, the frequency with which the transactions occur, and the type and degree of uncertainty to which the transactions are subjected. The basic assumption is that if the values of these dimensions are very high, full vertical integration (i.e. in-sourcing) may be the appropriate way to go, whereas if the values of the dimensions are very low, the horizontal integration (i.e. out-sourcing) may be considered.

In addition, the decision-making process on whether to insource or outsource maintenance services is influenced by a number of factors, including the expected quality of service delivery or outcome, hence adoption of the theory of rational decision-making for the study. Kelly (2003) opines that Game Theory is a key element in most decision-making processes involving two or more people or organisations. Furthermore, game theory can predict the outcome of complex decision-making processes and can help managers improve their negotiation and decision-making skills.

This study also investigates the post-adoption satisfaction of users of buildings in tertiary institutions in South-West Nigeria as a function of their expectations, perceived performance, and disconfirmation of beliefs about maintenance services. Although a number of theoretical

approaches have been utilised to explain the relationship between disconfirmation and satisfaction, there are a number of theories surrounding the satisfaction and service paradigm. The study, therefore, adopts the Expectancy Disconfirmation Theory for investigating customer satisfaction with maintenance services in the tertiary institutions.

2.8.1 Transaction Cost Theory

The theory of transaction cost was initiated by Williamson (1981) as an analytical tool for explaining economic challenges. According to him, the theory facilitates analysis of the comparative costs of planning, adapting and monitoring task completion under alternative governance structures. This theory maintains that the organisation of economic activity depends on balancing production economics, such as scale, against the cost of transacting. In this perspective, organisational success depends on managing transactions efficiently. According to the theory, transaction costs arise at contracting or at implementation. Muchai and Acosta (2012) posit that decision-makers must weigh and compare the costs associated with executing a transaction within their firms (insourcing) and outsourcing.

Ikediashi and Okwuashi (2015) further explain that Transaction Cost Economics ensures that economic efficiency is achieved and that comparative analysis of production and transaction costs is exchanged between parties to a transaction. In other words, transactions that have low asset specificity, low uncertainty and high frequency of contracting should be outsourced while the reverse should be the case in order to use in-house staff. There are however factors that impact transaction costs, such as Asset Uniqueness, Newness of Technology, Investment in Technology, and Supplier Market Competition. Figure 2.2 shows how these factors relate and impact transaction costs. Mahnke, Overby and Vang (2003) note that transactions have three critical dimensions: frequency of transactions, uncertainty (behavioural and

environmental), and the degree of asset specificity. They state that if these dimensions assume high values internal governance is implicated.

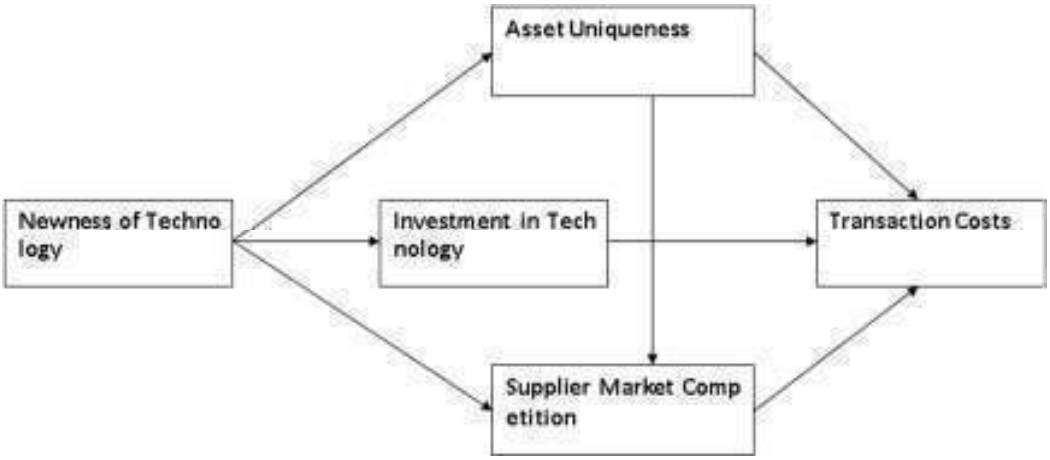

Figure 2.2: Factors impacting transaction costs (Lee *et al*., 2000)

According to transaction cost theory, activities will be internalised or outsourced depending on the relative transaction and production costs associated with services. Thus, by measuring transaction costs, it should be possible to provide significant guidance as to whether activities should be insourced or outsourced. The transaction cost approach offers a method of evaluating the relative advantages of the different internal and external organisation forms for handling transactions. This theory also provides an excellent framework for analysing the outsourcing option, since the essential choice here is between using an outsourcing service provider (a market mechanism) and providing in-house services (an organisational hierarchy) (Dingsdag, Biggs, Sheahan & Cipolla, 2006; Bergkvist, 2008; Toossi, 2011; Hargreaves, 2013; Stanimirovic, 2013).

Furthermore, the infrequency of contracting might increase associated transaction costs owing to initial 'relationship building' during contract negotiation. The consistency of goals between the contracting parties is critical to promoting this relationship. It should be

recognised, however, that certain information system functions tend to be inherently more 'commoditized' and can benefit from market relationships (i.e., lower asset specificity, uncertainty and higher frequency of contracting) such as transaction processing, while others such as specialised application development might benefit from hierarchical relationships.

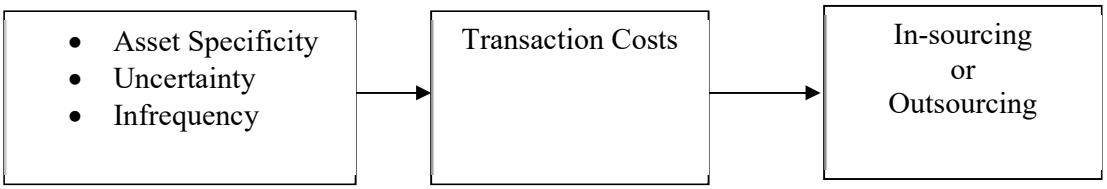

Figure 2.3: A transaction costs perspective of sourcing (Cheon, Grover & Teng, 1995)

Figure 2.3 indicates the relationships among transaction costs, their determinants and the choice to insource or outsource. If outsourcing, each of these factors raises the effort and cost of structuring an agreement between the service receiver and provider that will assure the successful completion of the contract and its future enforcement. Based on the factors determining the magnitude of transaction costs (or the relative trade-off between transaction and production costs), the decision to outsource can be expressed mathematically as the following linear relationship:

Outsourcing = f (transaction costs)

Transaction costs = f (asset specificity, uncertainty, infrequency)

Therefore, Outsourcing = f (asset specificity, uncertainty, infrequency).

In summary, the theory propounds that as uncertainty and volume of activities of a particular asset increase so does the tendency to internalise (in-source) activities for such asset. In other words, functions are only outsourced if they do not rely on specific assets, are not subject to a high degree of uncertainty, and are activities that the firm, organisation or institution relies on infrequently. Thus, for many empirically oriented sourcing strategies, scholars use the

transaction cost paradigm to frame their research design. The study utilises this approach to assess the level at which maintenance activities are insourced and outsourced in tertiary institutions in South-West Nigeria.

2.8.2 Game Theory

Kelly (2003) states that game theory is the science of strategic decision-making, a powerful tool for understanding how relationships are made and broken in the course of competition and cooperation. However, it is not a panacea for the shortcomings of bad management. For managers, or for those who interact with management, it is simply an alternative perspective within which to view the process of problem-solving. It is a tool which, like all others, is best used by those who reflect on their own practice as a mechanism for improvement. Game theory is based on the observation that individuals are more likely to adopt behaviour that appears to be successful for others (Gintis, 2009). Game theory is the most popular means of modelling the conflict between two or more decision-makers (Hamidi, Liao & Szidarovszky, 2014).

According to Barron (2013), game theory is the branch of decision theory that is concerned with interdependent decisions. The problems of interest involve multiple participants, each of whom has individual objectives related to a common system or shared resources. Because game theory arose from the analysis of competitive scenarios, the problems are called games and the participants are called players. A game typically involves several players; a game with only one player is usually called a decision problem. A game lays out the players, their preferences, their information, the strategic actions available to them and how these influence the outcome (Turocy & Stengel, 2003). These techniques, however, apply to more than just sport and are not even limited to competitive situations. Hence, game theory (Barron, 2013)

deals with any problem in which each player's strategy depends on what the other players do. This study adopts game theory for investigating the process of decision-making by policymakers in tertiary institutions in South-West Nigeria on whether to insource or outsource maintenance services and how these decisions impact on the quality of maintenance services and the conditions of buildings in the selected tertiary institutions.

2.8.3 Expectancy Disconfirmation Theory

Oh (1999) notes that the heart of the satisfaction process in any field of human endeavour is the comparison of what was expected with the product or service's performance. This process has traditionally been described as the 'confirmation/disconfirmation' process. There are two steps in the disconfirmation process. First, customers would form expectations prior to purchasing a product or service (Singh & Khanduja, 2010). Second, consumption of or experience with the product or service produces a level of perceived quality that is influenced by expectations (Siami & Gorji, 2012). If perceived performance is only slightly less than expected performance, assimilation will occur and perceived performance will be adjusted upward to equal expectations. If perceived performance lags behind expectations substantially, the contrast will occur and the shortfall in the perceived performance will be exaggerated (Adat & Noel, 2014).

Pereira, Ramos, Andrade and Oliveira (2015) explain that the expectancy disconfirmation theory argues that 'satisfaction is related to the size and direction of the disconfirmation experience that occurs as a result of measuring service performance against expectations. In general, satisfying customers is important from different perspectives. On their part, Lorenzo, Calderón, & Centeno (2010) note that the SERVQUAL model is a strategy for measuring service (SERV) and quality (QUAL) which has five generic factors: tangibility,

reliability, responsiveness, assurance, and empathy. It is based on comparisons between customers' expectations and their perception of actual performance. Satisfaction is generally taken to mean an evaluative attitude towards some object or experience (Singh & Khanduja, 2010). Hence, this study adopts the expectancy disconfirmation theory as the underlying theory for assessing the satisfaction of users of tertiary institution buildings with the quality of maintenance services that are delivered across the various tertiary institutions in South-West Nigeria.

2.9 Conceptual Framework

A conceptual framework integrates the underlying theory of a study (Klingenberg & Boksma, 2012) with a view to assisting the researcher in the development or adoption of a well-validated pictorial representation of variables for the study.

The conceptual framework for this study was supported by the models of previous researchers on insourcing and outsourcing services (Adelakun, 2003; Natukunda & Pitt, 2011; Vasiliauskiene, Snieska, & Venclauskiene, 2011; Pena, 2012) and maintenance management of buildings (Marilyn, 2006, Adenuga, 2012; Choka, 2012). The components adapted from the models of previous researchers for the conceptual framework include; the relationship between organisation characteristics and the level of sourcing practices proposed by Adelakun (2003), factors influencing sourcing decision proposed by Natukunda and Pitt (2011) and Vasiliauskiene, Snieska and Venclauskiene (2011), service quality measures proposed by Pena (2012) and the variables for evaluating the condition of buildings proposed by Marilyn (2006), Adenuga (2012) and Choka (2012).

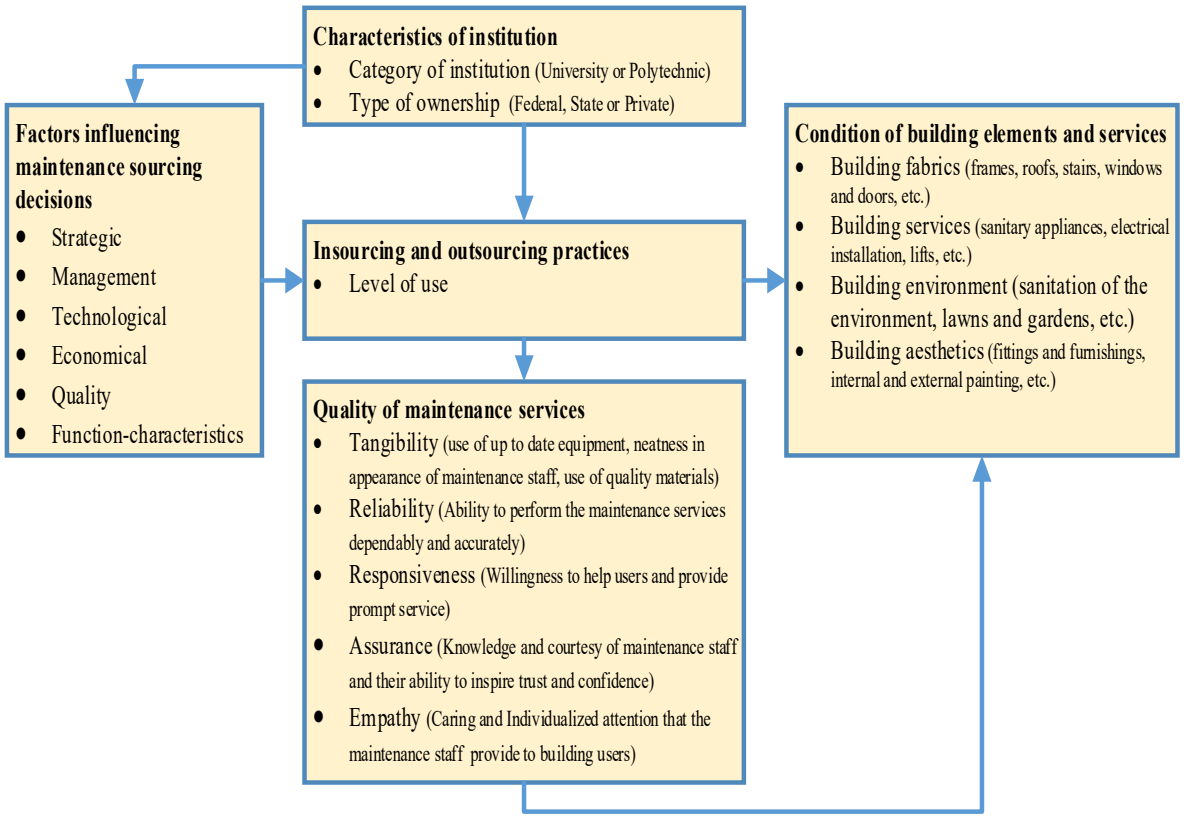

Figure 2.4: Conceptual framework for the study developed by the author

The conceptual model as shown in Figure 2.4 presents five interdependent constructs dimensions conceived by the author to be essential to insourcing and outsourcing practices of maintenance management of buildings in tertiary institutions. The conceptual framework shows that the condition of building elements and services can be predicted by the quality of maintenance services based on insourcing or outsourcing practices. Furthermore, the framework suggests that the characteristics of each institution would influence the factors that are considered when contemplating whether to insource or outsource maintenance services in the institution. The level at which an institution in-source or outsource maintenance services was conceptualised to be influenced by both the decision factors and the institution characteristics. The conceptual framework provided the necessary guide for developing the processes adopted in the investigation of established variables for this study.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter discusses the research method used in the collection and processing of data for this study. Research methodology involves the method of data collection and analysis for the research work (Creswell, 2003). It is necessary to consider the full range of possibilities for data collection in any study and to organise the methods by their degree of predetermined nature, their use of closed-ended versus open-ended questioning and their focus for numeric versus non-numeric data analysis. Therefore, the choice of research method is seen by many researchers as a decision laden with political ramifications (Tracy, 2013). The chapter describes, among others, the study's research design, sample and sampling procedure, as well as the research data, area, and population. It also explains the instrument used for the collection of data for the study, as well as the procedure for the validity and reliability test of the research instrument.

3.2 Research Approach

The commonest approaches to research are the quantitative, qualitative or mixed approaches. This study deals mainly with behavioural issues in eliciting responses to "how much" and "how often" questions; it, therefore, adopts a descriptive survey technique using the quantitative approach. A qualitative approach to research is likely to be associated with an inductive approach to generating theory, often using an interpretivist model that allows for multiple subjective perspectives and constructing knowledge rather than seeking to "find" it in "reality" (Melorose, Perroy & Careas, 2015).

One reason for adopting the quantitative approach, according to Adenuga and Ibiyemi (2012), is that it affords an objective measurement of the subject under analysis and facilitates replication (adoption and verification) by others. Daniel and Berinyuy (2010) explain that the quantitative strategy emphasises quantification in the collection and analysis of data and it entails a deductive approach to the relationship between theory and research. It also assumes a natural scientific model of positivism in particular and involves a view of social reality as an external, objective reality.

Naoum (2012) argues that the choice of an appropriate research methodology is dependent on the research topic and specific research questions. The method must also have its origin in two fundamentally different and competing schools of thought, i.e. logical positivism and phenomenological schools of thought. Logical positivism uses quantitative and experimental methods (Rugg & Petre, 2007) to test hypothetical deductive generalisations, while phenomenological inquiry uses qualitative and naturalistic approaches to inductively and holistically understand human experience in specific contexts.

According to Tracy (2013), survey research has several inherent strengths compared to other research methods: it is an excellent vehicle for measuring a wide variety of unobservable data, such as people's preferences, traits, attitudes, beliefs, behaviour, or factual information; survey research is also ideally suited for remotely collecting data about a population that is too large to observe directly. A large area, such as an entire region of a country, can be covered using mail-in, electronic mail, or telephone surveys using meticulous sampling to ensure that the population is adequately represented in a small sample; due to their unobtrusive nature and the ability to respond at one's convenience, questionnaire surveys are preferred by some respondents; interviews may be the only way of reaching certain population groups, such as

the homeless or illegal immigrants for which there is no sampling frame available; large sample surveys may allow detection of small effects even while analysing multiple variables, and depending on the survey design, may also allow comparative analysis of population subgroups (within-group and between-group analysis); survey research is economical in terms of researcher's time, effort and cost than most other methods, for example, experimental research and case research.

The justification for the choice of a quantitative approach for this study is premised on the aforementioned advantages of quantitative research. Furthermore, the survey research method is best suited (Bhattacheherjee, 2012) for studies that have individual people as the unit of analysis. Although other units of analysis, such as groups, organisations or pairs of organisations can also be studied using surveys, such studies often use a specific person from each unit as a "key informant" or a "proxy" for that unit. However, such surveys may be subject to respondent bias if the informant chosen does not have adequate knowledge or has a biased opinion about the phenomenon of interest. Sakburanapech (2008) states that qualitative research is exploratory in nature and therefore attempts to deduce answers to "how" and "why" questions, while quantitative research answers the questions of "how much" or "how many".

3.3 Research Design

A research design provides a framework for the collection and analysis of data (Creswell, 2003). A choice of research design reflects decisions about the priority given to the following: expressing causal connections between variables, generalising to larger groups of individuals than those actually forming part of the investigation, understanding the behaviour and

meaning of that behaviour in its specific social context and having a temporal (i.e. overtime) appreciation of social phenomena and their interconnections (Bhattacheherjee, 2012).

There are five different types of research design: experimental design; cross-sectional or social survey design; longitudinal design; case study design; and comparative design (Driscoll, Salib, & Rupert, 2007). This study adopted the cross-sectional survey design, which entails the collection of data on more than one case and at a single point in time in order to collect a body of quantitative or quantifiable data in connection with two or more variables, which are then examined to detect patterns of association (Hughes, 2006). This design considers more than one case because it is interested in the association between cases at a single point in time; this means that data are collected on variables simultaneously. Data must be quantifiable in order to establish variation between cases. This design also allows examination of the relationship between variables and no causal inference can be established because data are collected simultaneously.

3.4 Research Study Area

This study was conducted in the South-West region of Nigeria because out of the 143 approved Universities and 103 approved Polytechnics in Nigeria, 29 Universities, and 14 Polytechnics are located there, thus accounting for 20% and 14% of the total Universities and Polytechnics in the country. The South-West geo-political zone comprises Lagos State (six [6] tertiary institutions), Ogun State (seventeen [17] tertiary institutions), Ondo State (four [4] tertiary institutions], Oyo State (five [5] tertiary institutions), Osun State (seven [7] tertiary institutions), and Ekiti State (four [4] tertiary institutions). Table 3.1 below shows the names and locations of the selected tertiary institutions.

Table 3.1: Location, name, and number of institutions

Location	Name of Institution	Number of Institutions per State
LAGOS	University of Lagos Lagos State University Caleb University National Open University Yaba College of Technology Lagos State Polytechnic	6
ONDO	Federal University of Technology Akure Ondo University of Medical Sciences Rufus Giwa Polytechnic Owo Achievers University Owo	4
OYO	University of Ibadan Ladoke Akintola University of Technology Ibadan City Polytechnic The Polytechnic, Ibadan The Ibarapa Polytechnic, Eruwa	5
OGUN	Mountain Top University Covenant University Christopher University Tai Solarin University	17

Location	Name of Institution	Number of Institutions per State
	Babcock University	
	Olabisi Onabanjo University	
	Chrisland University	
	Crescent University	
	Federal University of Agriculture	
	Abeokuta	
	Federal Polytechnic Ilaro	
	Gateway Polytechnic Sapade	
	D.S Adegbenro Polytechnic	
	Moshood Abiola Polytechnic Abeokuta	
	Abraham Adesanya Polytechnic	
	Ogun State Institute of Technology	
	Bells University	
	Crawford University	
	Obafemi Awolowo University	
	Redeemers University	
	Adeleke University	8
OSUN	Bowen University	
	University of Osun State	
	Federal Polytechnic Ede	
	Wolex Polytechnic Iwo	
EKITI	Ekiti State University	4

Location	Name of Institution	Number of Institutions per State
	Afe Babalola Private University	
	Federal University Oye-Ekiti	
	Federal Polytechnic Ado-Ekiti	
Total number of tertiary institutions		**43**

The geographical location of each of the six (6) states constituting the area of this study is shown in Figure 3.1.

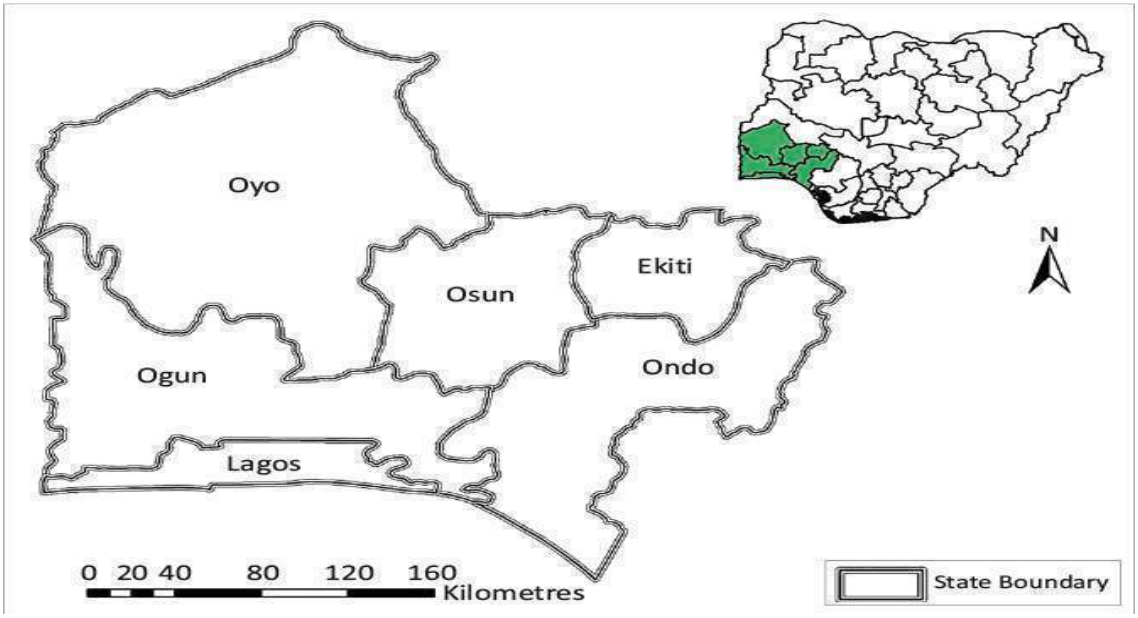

Figure 3.1: Map showing the South-West region of Nigeria

Source: Lawal and Arokoyu (2015).

Ogun State has the highest number of approved tertiary institutions among the six states of the South-West region of Nigeria with seventeen (17) tertiary institutions. The state was created in 1976 from the former Western State. It covers a total of 1,640,076 sq.km of landmass over 60 percent of which is cultivable land, with an estimated population of about 3.391 million. Although there were only six (6) of the surveyed tertiary institutions in Lagos

State, the tertiary institutions in Lagos State attract students from across the country because until December 1991 Lagos was the capital city of Nigeria and it remains the economic nerve centre of the country. Lagos State has the largest concentration of industries, financial institutions and major seaports in Nigeria. Although the state is the smallest in area among the thirty-six (36) states of Nigeria, with about 3,577 sq.km geographical area, the human population of the state is however in excess of 9 million people (National Population Commission, 2009). Lagos State is bounded on the North and East by Ogun State, while in the West it shares boundaries with the Republic of Benin. Behind its southern borders lies the Atlantic Ocean and 22% of its 3,577 km2 is made up of lagoons and creeks. The remaining four (Oyo, Osun, Ekiti, and Ondo) states are equally characterised with vibrant economic activities. Each of the states equally has a significant number of tertiary institutions, both public and private. This justifies the adoption of South-West, Nigeria as the study area.

3.5 Population of the Study

The population of a study refers to the totality of cases in which a researcher is interested (Healey, 2008); it has also been defined as the full universe of people or things from which the sample is selected (Melorose *et al*., 2015). The population for this study was comprised of the maintenance staff and users of all tertiary institutions in South-West Nigeria. The tertiary institutions comprise Federal, State and Private universities and polytechnics within the study area. The users of tertiary institution buildings were the academic and administrative staff as well as students of the various tertiary institutions. Maintenance staff were the maintenance technical staff and management staff of the maintenance department coordinating the various maintenance activities in tertiary institutions in South-West Nigeria. This study administered structured questionnaires to maintenance staff of the tertiary institutions across the South-West region of Nigeria. The maintenance staff comprised of

maintenance technical officers and maintenance managers. The technical officers were those with semi-skilled and skilled training in the repair and maintenance operations of specific building trades, and are involved in the day-to-day operations of various aspects of buildings in their institutions. The maintenance managers were those professionals involved in decision-making relating to maintenance management functions in the various tertiary institutions.

3.6 Sampling Techniques

This section explains the techniques adopted in the selection of the samples for this study. Three categories of respondents were selected for this study comprising maintenance managers, maintenance technical staff, and the building users. The technique used for the maintenance managers was a census that sampled every member of the population (Creswell, 2002; Israel, 2013). The purposive sampling technique was used for the maintenance technical staff to ensure that the research instruments were completed by targeted respondents, while the proportionately stratified sampling technique was used for the users of the building (Pandey & Pandey, 2015).

3.6.1 Maintenance Manager

The phenomena of interest in this study are insourcing and outsourcing maintenance management practices in tertiary institutions in South-West Nigeria. Therefore, critical to these issues were the responses of the topmost members of staff in the maintenance unit of each institution. A purposive sampling technique was adopted to elicit information from the maintenance manager and maintenance technical staff in each of the tertiary institutions because they were considered to be the most appropriate respondents on decisions related to

maintenance. This technique allows for the gathering of data on the factors that influence the decision-making process of the maintenance managers (Clark & Creswell, 2015).

3.6.2 Maintenance Technical Staff

The maintenance technical staff was comprised of technical officers of various sub-units within the maintenance unit. To obtain a sample that would be representative of the population, the stratified random sampling technique was used. The population of all maintenance staff in tertiary institutions within the study area was subdivided into homogeneous subsets (subpopulations), known as strata, that is, based on subunits such as the electrical, mechanical, parks and garden, cleaning, waste and sewage units, among others. From each of these strata, a sample size was then drawn. Inferences drawn from these samples were generalised to the total sampling population.

Melorose *et al*. (2015) explain that stratified sampling specifies any characteristics that a researcher might wish to be equally distributed among the sample. Provided the sampling frame can be easily identified by these characteristics, the stratum for each characteristic is identified and within each group, random sampling or systematic sampling can proceed. To proceed with the sampling, Israel (2013) suggests, three criteria would usually be required to be specified to determine the appropriate sample size. These criteria include the level of precision, the level of confidence or risk, and the degree of variability in the attributes being measured. There are several approaches to determining the sample size. These include using a census for small populations, imitating a sample size of similar studies, using published tables, and applying formulae to calculate the appropriate sample size (Clark & Creswell, 2015; Israel, 2013).

3.7 Sample Frame and Sample Size

3.7.1 Sample Frame

A sample frame is the list of elements in the population from which a sample is actually drawn (Cooper & Schindler, 2014). The numbers of universities and polytechnics in Nigeria, as approved by the National Universities Commission (NUC) and the National Board for Technical Education (NBTE) and as retrieved on the 15th July 2016 from the archives of NUC (http://nuc.edu.ng/#) and NBTE (http://www.nbte.gov.ng/institutions.html), were 143 and 103 respectively. Forty-three (43) of the tertiary institutions comprising 29 universities and 14 polytechnics from the approved institutions are located in South-West Nigeria. They were the sample frame for the study. The names of the institutions are shown in Table 3.1. Ogolo (1996) notes that for a finite population at least 10% of the population must be researched. The 29 universities and 14 polytechnics represent 20% and 14% of the total universities and polytechnics in Nigeria. This satisfied the 10% threshold, which implies that the study of forty-three (43) tertiary institutions in South-West Nigeria is a good representation of all the tertiary institutions in Nigeria.

Technically, three categories of respondents made up the population for this research, viz: maintenance managers, maintenance technical officers, and users of the buildings. The maintenance managers' population was relatively small, as only one maintenance manager was surveyed per institution. The maintenance technical officers had a varied population across the institutions, while the users of tertiary institution buildings had a large population.

3.7.2 Sample Size

Lenth (2001) posits that the determination of sample size is an important aspect of planning a statistical study. As mentioned earlier, three sample sizes were determined for this study.

The first sample size was determined using a census, which is useful for achieving a desirable level of precision for a small population, for example, a population of 200 or less (Israel, 2013). A census of the maintenance managers in each of the institutions was conducted in the course of this study. This was done in order to elicit information concerning insourcing and outsourcing maintenance activities in their respective institutions. The maintenance manager in the context of this study refers to the most superior officer in the maintenance department of an institution. It was observed in the course of this study that the designation for the most superior maintenance officer in the maintenance department varies across the institutions. In some cases, the most superior officer in the maintenance department was the Director of Works and Physical Planning, while in others it was the Head of Administration.

The second sample size was determined using the simplified formula for proportions by Yamane (1967). This method was used to determine the sample size for the maintenance technical staff based on their population per state. The maintenance technical staff are middle-level managers responsible for the supervision and coordination of maintenance activities in the institutions. This category of respondent excludes artisans working in the maintenance department of the various institutions.

The sample for the users of tertiary institution buildings was determined using Cochran's (1977) formula for a representative sample from large populations. Table 3.2 below shows the sample size for the three categories of respondents for this study. The first sample for this study was a census of all the 43 maintenance managers in tertiary institutions across South-West Nigeria. The 43 maintenance managers were made up of six (6) maintenance managers from tertiary institutions in Lagos State, four (4) maintenance managers from tertiary institutions in Ondo State, five (5) maintenance managers from tertiary institutions in Oyo

State, seventeen (17) maintenance managers from tertiary institutions in Ogun State, seven (7) maintenance managers from tertiary institutions in Osun State and four (4) maintenance managers from tertiary institutions in Ekiti State.

Table 3.2: Sample sizes for this study.

State	NOI	Maintenance manager		Maintenance technical staff		Building users	
		N	SS	N	SS	N	SS
LAGOS	6	6	6	31	29	146,750	54
ONDO	4	4	4	12	12	65,500	36
OYO	5	5	5	20	19	83,000	45
OGUN	17	17	17	72	61	181,500	152
OSUN	7	7	7	27	25	82,000	62
EKITI	4	4	4	14	14	37,700	36
TOTAL	**43**	**43**	**43**	**176**	**160**	**596,450**	**385**

Source: Author's compilation and computation

Note: NOI= Number of institutions, N= Population size, SS = Sample size,

The simplified formula for proportions (Yamane, 1967) was used to determine the sample size for maintenance technical staff. At a 95% confidence level and a 0.05 precision level, the proportionate sample sizes for each state stratum of the population were calculated using the formula:

$$\text{Minimum sample size (S)} = \frac{N}{1+N(e)^2} \qquad \ldots\ldots\ldots 3.1$$

Where S is the minimum sample size,

N is the population size and

e is the level of precision

Table 3.2 shows the proportionate sample sizes for the maintenance technical staff in each of the states based on the population of maintenance technical staff across the institutions. The sample size for each of the state locations of the institutions was calculated using the

proportionate sample size formula as shown in Equation 3.1. The desired degree of accuracy influences the sample size, as a higher degree of accuracy would result in a larger sample size (Clark & Creswell, 2015). For this study, ±5% was the desired degree of accuracy; consequently, the calculated sample sizes for the maintenance technical staff of tertiary institutions in the South-West are as follows: Lagos 29, Ondo 12, Oyo 19, Ogun 61, Osun 25, and Ekiti 14, making a total of one hundred and sixty maintenance technical staff as the minimum sample size needed for all the tertiary institutions in South-West Nigeria.

The third category of respondents for this study comprised the users of tertiary institution buildings in South-West Nigeria. These were academic and administrative staff as well as students of the tertiary institutions in South-West Nigeria. The population of this category of respondents was considered to be large. Therefore, this study adopts Conroy's (2006) suggestion that a population is considered large when the elements are larger than five thousand (5000). Israel (2013) opines that Cochran's (1977) formula is one of the appropriate methods for determining the sample size for large populations. This study employed the Cochran (1977) formula for determining sample size from a large population as shown in Equation 3.2. This was used to calculate the sample size for the users of tertiary institution buildings in South-West Nigeria.

Minimum sample size (S) = $\frac{Z^2 * p * (1-p)}{e^2}$ …….. 3.2

Where S is the minimum sample size,

Z is the abscissa of the normal curve that cuts off an area α at the tails (1-α equals the desired confidence level, i.e. 95%),

p is the expected or probability of previous similar studies (taken as 50% for this study) and

e is the desired level of precision

The computation of the sample size for users of tertiary institution buildings in South-West Nigeria is shown below:

$$\text{Sample size (S)} = \frac{Z^2 * p * (1-p)}{e^2} = \frac{(1.96)^2 * 0.5 * 0.5}{(0.05)^2} = 385 \text{ building users}$$

Applying the formula in equation 2, at a 95% confidence level and ±5% level of precision, the resulting sample size for the users of buildings in tertiary institutions in South-West Nigeria was found to be 385 building users.

3.8 Data Collected for the Study

Primary and secondary data were collected for this study. The primary data were collected through copies of structured questionnaires. The questionnaires were administered to each of the respondents. The three categories of respondents for this study were the maintenance managers, maintenance technical staff, and users of tertiary institution buildings in South-West Nigeria. Other primary data used for this study were relevant extracts from books, journals, articles, conference proceedings, technical reports, and papers, among others. In addition, the secondary data for this study included information on universities and polytechnics located in the six (6) states of the South-West geo-political zone. This information was collected from the archives of the National Universities Commission (NUC) and the National Board for Technical Education (NBTE).

3.9 Data Collection Instrument

3.9.1 Research Instruments

Structured questionnaires were used as the research instrument for this study. Pandey and Pandey (2015) state that the use of questionnaires to gather data has a number of advantages. For example, questionnaire surveys are economical and time-saving; they also cover research in a wide area, are very suitable for special types of responses and are most reliable in special cases. The questionnaires developed to collect data for this study were in two sets. These were used as the principal instruments for obtaining responses from the targeted respondents. There was a questionnaire for tertiary institutions' maintenance staff (comprising the maintenance managers and maintenance technical staff) and a questionnaire for users of tertiary institution buildings (comprising academic staff, administrative staff, and students).

3.9.2 Administration of the Research Instrument

The questionnaires were self-administered and each copy was delivered by hand to targeted respondents across the forty-three (43) tertiary institutions in South-West Nigeria. The researcher engaged the services of research assistants for this purpose. Telephone calls were made to potential respondents who were unable to complete the questionnaires on the spot. And repeated visits were made to institutions that were on holiday or on strike during the data collection exercise. Repeated visits were also made to potential respondents to retrieve the questionnaires that could not be completed on the spot, while in a few cases the respondents mailed the completed questionnaires to the researcher.

3.9.3 Questionnaire Design

Two sets of structured questionnaires were designed for this study. The first set was designed to elicit information from maintenance managers and the maintenance technical staff in

tertiary institutions. The second set was designed to elicit information from the users of tertiary institution buildings, comprised of academic and administrative staff as well as students of tertiary institutions. Both sets of questionnaires contained mostly closed-ended questions, with only a few of them being open-ended. Creswell (2013) posits that a survey research provides a quantitative description of the trends, attitudes or opinion of a population by studying a sample of that population with the intent of generalising from it.

In designing the questionnaires for this study, a number of guidelines were followed in order to enhance the quality of responses obtained from the respondents as well as to improve the response rate. To achieve this, a few steps were taken.

The wording of the questionnaires was kept simple. Abbreviations and jargon were avoided (Mertens, 2014) so that all the respondents could easily comprehend and respond to the questions. Lee (2006) posits that it is a good practice in survey research to pilot-test the research instrument. The questionnaires were pilot-tested on tertiary institutions in Lagos and Ogun states. The pilot study provided an opportunity to identify some shortcomings with respect to the adequacy of some questions in the initial questionnaires. The questionnaires were subsequently re-adjusted and modified to better suit the study.

According to Diem (2002), the meaning of rare or technical words used in any survey instrument should be expressly stated. The meanings of technical terms used in some sections of the questionnaires for this study (such as insourcing, outsourcing, and hybrid) were explained. This was done so as to eliminate the chances of ambiguity in the questionnaires.

More explicitly, Pandey and Pandey (2015) highlight twelve characteristics of a good questionnaire which the researcher considered when designing the questionnaire for this

study. These characteristics include; it deals with an important or significant topic, its significance is carefully stated on the questionnaire itself or on its covering letter, it seeks only that data which cannot be obtained from the resources like books, reports, and records, it is as short as possible, only long enough to get the essential data, it is attractive in appearance, neatly arranged and clearly duplicated or printed, directions are clear and complete, important terms are clarified, the questions are objective, with no clues, hints or suggestions, duestions are presented in an orderly form – from simple to complex, double negatives, adverbs, and descriptive adjectives are avoided, double-barreled questions or putting two questions in one question are also avoided, the questions carry an adequate number of alternatives, it is easy to tabulate, summarize and interpret.

Two sets of questionnaires were designed and administered for this study. One set was administered to the maintenance staff while the second set was administered to the users of the buildings in the surveyed institutions. Each of the questionnaires was designed with a cover letter introducing the study to potential respondents and explaining the aim of the data collection process for which their support was solicited. The covering letter also assured potential respondents that the data being collected would be used strictly for academic purposes; it also assured them of the confidentiality of information to be provided.

The first set of questionnaires administered to the maintenance staff of the tertiary institutions in South-West Nigeria consisted of two primary sections, A and B. Section A elicited demographic information from the respondents, based on ten (10) questions to do with age, gender, level of formal education and the category of tertiary institutions they work for. Section B had four (4) subsections and the first two subsections sought to ask questions on the sourcing strategies and the level of use of each of the sourcing strategies for carrying out

maintenance management activities in their respective institutions. Furthermore, questions probing into factors influencing the decision of the maintenance management team on whether to insource or outsource maintenance services were asked. Finally, the maintenance managers were asked to assess the condition of key building elements and services in their respective tertiary institutions.

The second set of questionnaires was administered to the users of the buildings in the various tertiary institutions in South-West Nigeria. Similar to the questionnaire for the maintenance managers, this questionnaire also had two primary sections, A and B. Section A elicited demographic information from the users of the buildings, such as name, age, gender, status, the name of respondents' institution and the state within which the institution. Section B was subdivided into three (3) subsections. The first subsection sought to elicit information from the users of the buildings on the condition of the building elements and services. The second subsection sought the opinion of tertiary institution building users on the factors influencing the decision of the maintenance management team on insourcing or outsourcing maintenance services. Finally, the third subsection sought to investigate the quality of maintenance services delivered by the maintenance team in tertiary institutions in South-West Nigeria.

3.10 Research Variables and Measurement

Brace (2008) states that research findings can be affected by a number of factors, including the choice of measurement tools for the research questions and order of the questions in the research instrument. The variables used in the study of insourcing and outsourcing practices in the maintenance management of tertiary institution buildings include the level of use of insourcing and outsourcing practices for the maintenance management of tertiary institution buildings, the factors influencing the decision to insource or outsource maintenance services,

the physical and functional condition of building elements and services. Furthermore, the quality of maintenance services provided by the maintenance department was assessed. A detailed description of the variables used in this study and their respective measurements is provided below.

3.10.1 Demographic Characteristics of the Respondents

This section of the questionnaire sought to elicit information on the name of the respondent's institution, the category of the institution of the respondent, the state in which the institution is located, the status of the respondent, the designation of the respondent, the gender of the respondent, the age of the respondent and the length of time during which the respondent has worked in the institution. The variables are labelled V1-V9 respectively. Additional demographic details were sought from the maintenance managers as contained in the questionnaire administered to maintenance managers. The additional demographic data were meant to assist the researcher to elicit information specific to the maintenance department or unit of the tertiary institutions under this study. The additional variables were labelled V212-V217. These variables were analysed using frequencies, percentages and bar charts.

3.10.2 Physical and Functional Condition of Building Elements and Services

The respondents were asked to assess the physical and functional condition of the various building elements and services that require maintenance activities in a typical tertiary institution building. The respondents were required to provide this assessment relative to whether the elements or services are maintained through insourcing or outsourcing. The respondents were provided with a 5-point Likert scale ranging from 1= very bad to 5= very good. The variables used to measure the physical and functional condition of the buildings were put into four categories, viz: building fabrics, building services, building surroundings

and environment, and building aesthetics. The measured variables making up the aforementioned categories include the following:

Condition of building elements and services maintained by insourcing

	Building Fabrics
V10	Frames (Columns and Beams)
V11	Upper floors
V12	Roofs
V13	Stairs
V14	External walls
V15	Windows and External doors
V16	Internal walls and partitions
V17	Internal doors
V18	Wall finishes
V19	Floor finishes
V20	Ceilings
V21	Nettings

	Building Services
V22	Sanitary appliances
V23	Services equipment
V24	Disposal installation
V25	Water installation
V26	Electrical Installation
V27	Gas Installation
V28	Lift and conveyor installation
V29	Protection installation
V30	Drainages
V31	External Services
V32	Ventilation System

Building Environment

V33	General sanitation of the environment
V34	Lawns and Gardens
V35	Car park and parking lots

Building Aesthetics

V36	Fittings and Furnishings
V37	Internal painting

The condition of building elements and services maintained by outsourcing:

Building Fabrics

V40	Frames (Columns and Beams)
V41	Upper floors
V42	Roofs
V43	Stairs
V44	External walls
V45	Windows and External doors
V46	Internal walls and partitions
V47	Internal doors
V48	Wall finishes
V49	Floor finishes
V50	Ceilings
V51	Nettings

Building Services

V52	Sanitary appliances
V53	Services equipment
V54	Disposal installation
V55	Water installation
V56	Electrical installation
V57	Gas installation
V58	Lift and conveyor installation
V59	Protection installation

V60	Drainages
V61	External services
V62	Ventilation system
	Building Environment
V63	General sanitation of the environment
V64	Lawns and gardens
V65	Car park and parking lots
	Building Aesthetics
V66	Fittings and furnishings
V67	Internal painting
V68	External painting
V69	External cornices on Façades

These variables were analysed using mean scores, paired samples t-tests, and one-way ANOVA. The mean scores were used to descriptively investigate how the building elements and services have performed based on the choice of sourcing approach used in carrying out maintenance activities on them. The paired samples t-test was used to investigate if there are significant differences in the perception of respondents on the physical condition of building elements and services that were maintained through insourcing, compared to those that are maintained through outsourcing. Finally, the one-way ANOVA test was carried out to establish if there are significant differences in the physical and functional conditions of building elements and services based on the type or category of institution.

3.10.3 Factors Influencing Decision to Insource or Outsource Maintenance Services

In the review of the literature, the factors influencing the decision of institutions or organisations to either insource or outsource services were examined. The prevalent factors were identified and were presented to respondents to rate the extent to which the decision

whether to insource or outsource was influenced by the factors. The rating scale presented to the repondents range from 1= not at all influential to 5= extremely influential. The factors that were presented to the respondents and their corresponding variable numbers are as follows:

V70	Maintenance urgency
V71	Institution reputation
V72	Maintenance is core to institution
V73	Threat to institution's cultural alignment
V74	Potential conflict of interest
V75	Difficulty in getting trustworthy subcontractors
V76	Economies of scale
V77	Difficult in contracting unpredictable activities
V78	Difficulty in appraising subcontractor's performance
V79	The potential loss of investment.
V80	Focus on core activities
V81	Access to world-class capabilities
V82	Freeing resources for core activities
V83	Accelerate re-engineering benefits
V84	Risk sharing with contractors
V85	Lack of internal resources for a service
V86	Improve flexibility to the changing market dynamics
V87	Strategic alliance with contractors
V88	Regulations governing outsourcing practices
V89	Save management time
V90	Reduce management load
V91	Need for specialised management
V92	Increase the speed of implementation
V93	Function difficult to manage
V94	Safety management
V95	Consolidation and decentralisation
V96	Achieve flexibility with changing technology
V97	Initiate innovative ideas and techniques
V98	Improve the technology for competitive advantage

V99	Technology requirements uncertainty
V100	Need for specialised expertise
V101	Acquire new skills or technical knowledge
V102	Save the overall cost
V103	Reduce the labour and operating cost
V104	Transform fixed cost into variable costs
V105	Improve the cash flow
V106	Cash infusion
V107	Make capital funds more available for core activities
V108	Increase the economic efficiency
V109	Improve service quality
V110	Improve quality requirements
V111	Achieve high quality of service for competitive advantage
V112	Procure higher reliability and competency
V113	Complexity of function
V114	Function integration and structure
V115	Lack of spare parts
V116	Function difficult to control
V117	Lack in equipment /tools availability

3.10.4 Expected Quality of Maintenance Services

Two sets of questionnaires were designed and administered for this study. One set was administered to the maintenance staff, while the second set was administered to the users of the buildings in the tertiary institutions. The expectations and perceptions of the respondents were rated on the scale ranging from 1= very to 5= extremely high respectively. For the expectation of the quality of services delivered by the in-house maintenance staff, the questions were phrased as follows:

V118	Maintenance staff should have modern-looking equipment
V119	Maintenance staff should have visually appealing physical facilities

V120	Maintenance staff should appear neat
V121	Maintenance staff should use quality and visually appealing materials
V122	Maintenance staff should act according to promises
V123	Maintenance staff should have sincere interest in solving problems
V124	Maintenance staff should perform services right the first time
V125	Maintenance staff should provide services at the time promised
V126	Maintenance staff should keep accurate records
V127	Maintenance staff should inform building users exactly when maintenance services will be provided.
V128	Maintenance staff should provide prompt services
V129	Maintenance staff should be always willing to help
V130	Maintenance staff should never be too busy to respond to service requests
V131	Maintenance staff behaviour should instil confidence in building users
V132	Building users should feel secure in their transactions with maintenance staff
V133	Maintenance staff should be consistently courteous
V134	Maintenance staff should have the knowledge to answer questions
V135	Maintenance staff should provide individual attention
V136	Maintenance staff should have operating hours convenient for building users
V137	Maintenance staff should provide personal attention
V138	Maintenance staff should have the best interest of the building users at heart
V139	Maintenance staff should understand the needs of building users

Similarly, the respondents were requested to rate their expectation of the quality of services delivered by the outsourced maintenance staff. The questions were phrased as follows:

V140 Maintenance staff should have modern-looking equipment

V141 Maintenance staff should have visually appealing physical facilities

V142 Maintenance staff should appear neat

V143 Maintenance staff should use quality and visually appealing materials

V144 Maintenance staff should act according to promises

V145 Maintenance staff should have sincere interest in solving problems

V146 Maintenance staff should perform services right the first time

V147 Maintenance staff should provide services at the time promised

V148 Maintenance staff should keep accurate records

V149 Maintenance staff should inform building users exactly when maintenance services will be provided

V150 Maintenance staff should provide prompt services

V151 Maintenance staff should be always willing to help

V152 Maintenance staff should never be too busy to respond to service requests

V153 Maintenance staff behaviour should instil confidence in building users

V154 Building users should feel secure in their transactions with maintenance staff

V155 Maintenance staff should be consistently courteous

V156 Maintenance staff should have the knowledge to answer questions

V157 Maintenance staff should provide individual attention

V158 Maintenance staff should have operating hours convenient for building users

V159 Maintenance staff should provide personal attention

V160 Maintenance staff should have the best interest of the building users at heart

V161 Maintenance staff should understand the needs of building users

3.10.5 Perceived Quality of Maintenance Services

In order to complete the evaluation of the quality of maintenance services delivered in the tertiary institutions being studied, the respondents were requested to rate their perception of the quality of maintenance services delivered by the in-house maintenance staff. The questions were phrased as follows:

V162 Maintenance staff has modern-looking equipment.

V163 Maintenance staff has visually appealing physical facilities

V164 Maintenance staff always appear neat.

V165 Maintenance staff use quality and visually appealing materials

V166 Maintenance staff act according to promises

V167 Maintenance staff has sincere interest in solving problems

V168 Maintenance services are performed right the first time

V169 Maintenance staff provide services at the time promised

V170 Maintenance staff keep accurate records

V171 Maintenance staff inform building users exactly when maintenance services will be provided

V172 Maintenance staff provide prompt services

V173 Maintenance staff are always willing to help

V174 Maintenance staff are never too busy to respond to service requests

V175 Maintenance staff behaviour instils confidence in building users.

V176 Building users feel secure in their transactions with maintenance staff

V177 Maintenance staff are consistently courteous

V178 Maintenance staff has the knowledge to answer questions

V179 Maintenance staff provide individual attention

V180 Maintenance staff work at times convenient for building users

V181 Maintenance staff provide personal attention

V182 Maintenance staff has the best interest of building users at heart

V183 Maintenance staff understands the needs of building users.

Similarly, the respondents were requested to rate their perception of the quality of maintenance services delivered by outsourced maintenance staff. The variables presented to the respondents were phrased as follows:

V184 Maintenance staff has modern-looking equipment

V185 Maintenance staff has visually appealing physical facilities

V186 Maintenance staff always appear neat

V187 Maintenance staff use quality and visually appealing materials

V188 Maintenance staff act according to promises

V189 Maintenance staff has sincere interest in solving problems

V190 Maintenance services are performed right the first time

V191 Maintenance staff provide services at the time promised

V192 Maintenance staff keep accurate records

V193 Maintenance staff inform building users exactly when maintenance services will be provided

V194 Maintenance staff provide prompt services

V195 Maintenance staff are always willing to help

V196 Maintenance staff are never too busy to respond to service requests

V197 Maintenance staff behaviour instils confidence in building users

V198 Building users feel secure in their transactions with maintenance staff

V199 Maintenance staff are consistently courteous

V200 Maintenance staff has the knowledge to answer questions

V201 Maintenance staff provide individual attention

V202 Maintenance staff work at times convenient for building users

V203 Maintenance staff provide personal attention

V204 Maintenance staff has the best interest of the building users at heart

V205 Maintenance staff understand the needs of building users

The users of the buildings were also asked to allocate weight to the features of maintenance services quality. The weight allocation was based on the order of importance of each the five features (comprising tangibility, responsiveness, reliability, empathy, and assurance) in the delivery of quality maintenance services. The weight allocation was expected to be proportionate to the importance of each of the feature by apportioning a total of 100 points among the five features. This section of the questionnaire was labelled V206 to V211.

3.10.6 Level of Use of Insourcing and Outsourcing Maintenance Practices

The level at which maintenance services were insourced or outsourced in tertiary institutions within the study area was assessed. This was done by asking the maintenance managers to indicate the sourcing option adopted for executing maintenance services for major maintenance activities. The variables labels for the insourced maintenance services include:

V218 Civil works and building fabrics

V219 Electrical maintenance

V220 Air-conditioner maintenance
V221 Generator maintenance
V222 Water System and borehole maintenance
V223 Water treatment plant
V224 Lift system maintenance
V225 CCTV Cameras maintenance
V226 Plumbing systems maintenance
V227 Intercom systems
V228 Internet services installations
V229 Fire protection systems
V230 Sewage evacuation and disposal
V231 Office cleaning
V232 Classroom cleaning
V233 Common areas cleaning (Toilets, corridors, stairs, etc.)
V234 Refuse and waste disposal
V235 Fumigation services
V236 Landscape and Gardens
V237 Internal painting
V238 External painting
V239 Others (please specify)

The variables labels for the outsourced maintenance services include:

V240 Civil works and building fabrics
V241 Electrical maintenance
V242 Air-conditioner maintenance
V243 Generator maintenance
V244 Water System and borehole maintenance
V245 Water treatment plant
V246 Lift system maintenance
V247 CCTV Cameras maintenance
V248 Plumbing systems maintenance
V249 Intercom systems
V250 Internet services installations

V251	Fire protection systems
V252	Sewage evacuation and disposal
V253	Office cleaning
V254	Classrooms cleaning
V255	Common areas cleaning (Toilets, corridors, stairs, etc.)
V256	Refuse and waste disposal
V257	Fumigation services
V258	Landscape and Gardens
V259	Internal painting
V260	External painting
V261	Others (please specify)

Furthermore, the maintenance managers were asked to indicate the preferred sourcing option for each of the listed maintenance services based on their past experience of the sourcing options and the quality of maintenance services derived from the sourcing options. For this purpose, the variables were labelled V262-V283.

3.11 Scales of Measurement

A variable is defined as a concept that can take on different quantitative values (Kothari, 2004) and it is important that a variable properly represent the concepts expressed in the questions (Lee, 2006). According to Bhattacheherjee (2012), measurement is the process by which a researcher assigns numbers or labels to variables or units of analysis in scientific research to represent their conceptual properties.

Measurement is referred to as the foundation of scientific inquiry (Kline, 2008). According to Brown (2011), the great majority of research studies require some forms of measurement, and whether a research hypothesis stands or falls may depend on how the key concepts have been measured, independently of whether or not it is a worthy hypothesis. Hence a researcher

must consider critically the scale of measurement to be used when determining the statistical analysis to be applied.

Scales of measurement are commonly classified into four types (Brown, 2011) as different types of data fall into four categories comprising nominal, ordinal, interval and ratio scales (Melorose *et al*., 2015). Furthermore, the categories in any variable at any level of measurement must be exhaustive which means that every unit of analysis used by a researcher must be able to be assigned to one of the four categories. Mutual exclusivity and exhaustiveness, therefore, constitute the minimal requirements for measurement, whether the measurement is nominal, ordinal, interval or ratio (Kline, 2008).

3.11.1 Nominal Scale

A nominal measure makes only a single, simple distinction: between the presence and absence of the theoretical concept within the unit of analysis. It is a simple black-or-white kind of view that is used to categorize the observed units (Kline, 2008). This means that it is not possible for any single unit of analysis to be a member of more than one category as a nominal measure are mutually exclusive. The nominal scale consists of individuals being classified into groups or categories without implication of graduation or distance between the groups. It is qualitative rather than quantitative (Bhattacheherjee, 2012).

According to Naoum (2012), the statistics which can be used with nominal scales, are in the non-parametric group and therefore the most likely ones are mode and cross tabulation with chi-square. The nominal scale was used in this research work to capture the demographic data of respondents for this study such as the age of the respondents, the gender of the respondents, the state where the institution is located among others.

3.11.2 Ordinal Scale

An ordinal scale is called a rank order measurement (Kline, 2008). This measurement takes on comparative degrees of difference, and this distinguishes an ordinal measure from a nominal one, in which there is only a single distinction of difference (in nominal measurement, an observation is the same as others in its category, and different from all other categories). This type of scale is measurement systems that consist of arranging variables in the proper order of magnitude. The numbers, in this case, indicate only the rank order of cases on some variables (Bhattacheherjee, 2012). Ordinal data makes use of non-parametric statistics like median and mode, rank order correlation and non-parametric analysis of variance.

The ordinal scale was used in this study to measure responses to questions on the physical and functional condition of building elements and services in tertiary institutions using the range of responses from very to very good. Also, the factors influencing the decision to insource or outsource maintenance services were assessed using the scale ranging from not at all influential to extremely influential. This study also assessed the expected and perceived quality of maintenance services. The respondents were asked to rate the extent to which they think the maintenance staff show possess the features of quality services using a 7 point Likert scale measure with 1 representing strongly disagree to 7 which represent strongly agree. In the same manner, the respondents were asked to rate the extent to which they believe the maintenance staff possesses the features of quality of services using a 7 point Likert scale measure with 1 representing strongly disagree to 7 as representing strongly agree.

3.11.3 Interval Scale

Interval scale of measurement has the qualities of the nominal and ordinal scales but the major difference is that in the interval scale, the distance between each observation is constant (Naoum, 2012). Interval scale does not only rank the order of observations, but it also assigns the variables numerical scores which register the degree of distance between observations or points on the measurement scale. In interval measurement, equal numerical distances imply equal dissimilarity (Kline, 2008).

In Parametric statistical techniques such as mean and standard deviation, correlation and regression analysis, ANOVA and factor analysis can be used for interval scale data. This scale was used in this study to assess the size of employees in the maintenance department of each of the tertiary institutions.

3.11.4 Ratio Scale

A ratio scale has the property of equal intervals but also has a true 0 point. As a result, one can multiply and divide as well as add and subtract using ratio scales. Units of time (m, sec, hours), distance and length (cm, kilometres), weight (mg, Kilos) etc are all ratio scale (Melorose *et al*., 2015). Ratio scale of measurement has two unique characteristics, the intervals between points can be demonstrated to be precisely the same and the scale has a conceptually meaningful zero point. Norman (2010) explain that ratio scale measurement differs from interval measurement only in that it implies the existence of a potential absolute zero value. The allocation of weight to the features of quality of service was done in this study using a ratio scale.

3.12 Method of Data Analysis

Data analysis refers to the process of studying (Pandey & Pandey, 2015) the organised information or data in order to discover inherent facts. In conducting data analysis, the set of data involved are studied from as many angles as possible with a view to exploring new facts. For a quantitative study or a survey, the data analysis of questionnaires involves coding questions and responses and deciding on how to aggregate the data for use by the researcher, analyst or evaluator (Lee, 2006). The nature of a study is the determinant of the appropriate method of analysis to be employed when carrying out the data analysis.

Williams (2007) opines that quantitative research creates meaning through objectivity uncovered in the collected data. In addition, quantitative research involves the collection of data so that information can be quantified and subjected to statistical treatment in order to support or refute alternate knowledge claims. Quantitative research also involves data collection that is typically numeric whenever the researcher tends to use mathematical models as the methodology of data analysis. In this study, the data are analysed to address each of the research objectives and hypothesis. Creswell (2002) posits that addressing research questions or hypothesis in quantitative research requires that the researcher does the following:

- Describe trends in the data to a single variable or question on the research instrument.
- Compare two or more groups on the independent variable in terms of the dependent variable. To do this, the researcher needs inferential statistics to analyse the data from a sample to draw conclusions about an unknown population. The researcher assesses whether the differences between groups (their means) or the relationship among variables is much greater or less than what would be expected for the total population if the entire population could be studied.

- Relate two or more variables. To answer this question, the researcher also requires inferential statistics.
- Test hypotheses about the differences in the groups or the relationships of variables. This also requires inferential statistics.

Thus, a researcher describes results to a single variable or question or infer results from a sample to a population. In all quantitative research questions or hypotheses, all individuals sampled are studied from a population.

According to Burgess (2001), the strength of the analysis carried out from any set of data depends on the quality of data which stems from the quality of design of the data collection instrument, i.e. the questionnaire, and of the data collection procedures used during the data collection exercise.

Data for the study was processed for omissions, consistency, and completeness. Data from duly completed questionnaires were analyzed with the aid of the Statistical Package for the Social Sciences (SPSS) version 23.0. Both descriptive and inferential research questions were analysed for this study. For the descriptive questions, only one variable is studied at a time while multiple variables are studied at the same time for the inferential analysis. The descriptive statistics were used to summarise the overall trends in the data for this study, provide an understanding of how varied the scores are, and provide insight into where one score stands in comparison with others in this study. Figure 3.1 shows typical inferential statistical procedures that were adopted for the inferential analysis carried out in the course of this study.

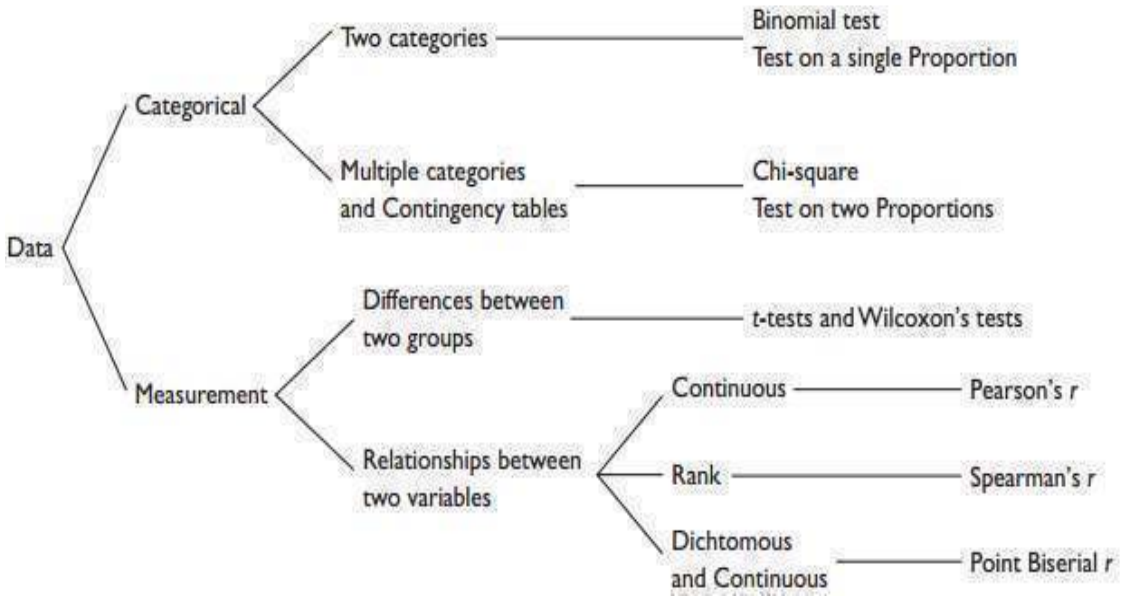

Figure 3.2: Typical inferential statistical procedures adopted for this study

Source: Gravetter and Wallnau (2016)

The descriptive statistic tools employed in the analysis of the data for this study include frequency, mean scores and mean differences while the inferential statistic tools include independent samples t-test, paired samples t-test, Analysis of Variance, data reduction analysis (Factor Analysis) and regression analysis.

3.12.1 Mean score

The mean is the most popular statistic used to describe responses of all participants to items on an instrument. A mean is the total of the scores divided by the number of scores. Mathematically, the mean is expressed as:

$$\bar{x} = \frac{\Sigma x}{n} \quad \text{..... 3.3}$$

Where x is the individual observations and n is the sample size

3.12.2 Relative importance index (RII)

RII aids in finding the contribution a particular variable makes to the prediction of a criterion variable both by itself and in combination with other predictor variables (Somiah & Aidoo, 2015). RII is expressed as:

$$\text{RII} = \frac{\sum W}{A*N} \quad \text{..... 3.4}$$

Where:

W= weight given to each factor by the respondents

A = is the highest weight

N = is the total number of respondents

3.12.3 Wilcoxon's signed-rank test

The Wilcoxon signed rank test, also known as the Wilcoxon matched pairs test, is a nonparametric test used to test the median difference in paired data. This test is the non-parametric equivalent of the paired t-test. The Wilcoxon signed-rank test is an improvement on the sign test in terms of detecting real differences with paired treatments. The steps of Wilcoxon's signed-rank test are;

1. Rank the differences between paired values from smallest to largest without regard to sign.

2. Assign the signs (tied ranks including both signs are given averages)

3. Obtain T+ and T- (sum of positive ranks and negative ranks respectively). Choose smaller one and call it T.

4. Compare T with the critical value. The small values of T are the significant ones.

3.12.4 One sample t-test

One sample t-test is used to test whether the mean of a normally distributed population is different from a specific value. A null hypothesis and alternative hypothesis is required to be formulated before a t-test is conducted. The null hypothesis (H_0) usually states that the population mean is equal to some value (μ_o) while the alternative hypothesis (H_1) usually states that the mean does not equal i.e is greater/less than μ_o. The t-statistics standardises the difference between $\bar{x}$ and μ_o. Mathematically, one sample t test is expressed as:

$$t = \frac{\bar{x} - \mu o}{\frac{s}{\sqrt{n}}} \quad \text{..... 3.5}$$

The degree of freedom (df) = n-1

3.12.5 Independent samples t test

The independent samples t-test test whether the mean of two groups is significantly different from one another. The samples are independent of each other although they are drawn from the same population pool. Mathematically, the independent samples t-test is expressed as:

$$t = \frac{\bar{x}_1 - \bar{x}_2 - 0}{s_P \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}} \quad \text{..... 3.6}$$

Where:

$$s_P = \sqrt{\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}} \quad \text{..... 3.7}$$

The assumptions for the independent samples t-test are as follows:

- The two samples are independent.
- The two samples are randomly selected from normally distributed populations.

- $\sigma_1^2 = \sigma_2^2$

3.12.6 Paired samples t-tests

The paired samples t-test tests whether the mean of two groups is significantly different from one another. If there is some relationship so that each value in one sample is paired with a corresponding value in the other sample, the samples are dependent. Dependent samples are often referred to as matched pairs or paired samples. Mathematically, the paired samples t-test is expressed as:

$$t = \frac{\overline{d}}{s_d / \sqrt{n}} \quad \ldots\ldots\ldots\ldots\ldots 3.8$$

The assumption upon which the paired samples t-test is based is that differences are randomly selected from a normal population of such differences.

3.12.7 Linear regression analysis

Regression analysis gives information on the relationship between a response (dependent) variable and one or more (predictor) independent variables to the extent that information is contained in the data. The goal of regression analysis is to express the response variable as a function of the predictor variables. Once a regression analysis relationship is obtained, it can be used to predict values of the response variable, identify variables that most affect the response, or verify hypothesized causal models of the response. The value of each predictor variable can be assessed through statistical tests on the estimated coefficients (multipliers) of the predictor variables. An example of a regression model is the linear regression model which is a linear relationship between response variable, y and the predictor variable, $x_i, i = 1,2..., n$ of the form:

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + ... + \beta_n x_n + \varepsilon \quad \text{..... 3.9}$$

Where:

$\beta_0, \beta_1 ..... \beta_n$ are regression coefficients (unknown model parameters), and

ε is the error due to variability in the observed responses.

3.13 Pilot Study

Kothari (2004) opine that prior to a full field collection of data for a study, a pilot study should be undertaken for pre-testing the questionnaire. The pilot study is essential so as to check the proposed questionnaire for weakness, if any as the questionnaire may be edited in the light of the results of the pilot study. A pilot of one tertiary institution in Lagos state and one in Ogun state was conducted for this study. Non-probability convenience sampling technique was used to select the two institutions used for the pilot study. Purposive sampling technique was employed in administering the pilot questionnaires to maintenance staff while questionnaires for the users were randomly administered.

The pilot study experience resulted in the modification of some sections of the questionnaires. For example, it was discovered that was the need to split questions seeking to elicit information on the sourcing option for cleaning services to accommodate the possibility of having different sourcing options for executing the services in key areas such as classrooms, offices and common areas.

3.14 Validity and Reliability of Research Instruments

A good research instrument must meet the tests of validity and reliability (Kothari, 2004). Once a research instrument is developed, the relevant questions the researcher should ask is

"what is the assurance that the questions are indeed measuring what they are intended to measure?" since the construct that is been measured is abstract, and "what is the assurance that if the instrument is repeated that the measurement will get the same result?" These are the two main questions about a good research instrument. The first question is related to validity and second to reliability (Thayer-Hart, Dykema, Elver, Schaeffer, & Stevenson, 2010). Validity and reliability, therefore, are two important characteristics of behavioural measure and are referred to as psychometric properties. It is important to bear in mind that validity and reliability are not an all or none issue but a matter of degree.

3.14.1 Validity

Validity is the most critical criterion and indicates the degree to which an instrument measures what it is supposed to measure (Kothari, 2004). In addition, Bhattacheherjee (2012) explain that validity is an indicator of how good an answer provided by research is for a given problem; that is whether the instruments measure what they are supposed to measure. Melorose *et al*. (2015) opine that there are various ways of characterizing validity in research studies which include: face validity, criterion-oriented validity, concurrent validity and construct validity.

- **Face Validity:** basically face validity refers to the degree to which a construct appears to measure what it purports to measure.

- **Criterion-Oriented or Predictive Validity**: where there is an expectation of a future performance based on the scores obtained at the moment by a measure and there is afterwards a correlation between the scores obtained with performance. The later performance is called the criterion and the current score is the prediction. This is an empirical check on the value of the test – a criterion-oriented or predictive validation.

- **Concurrent Validity**: concurrent validity is the degree to which the scores on a test are related to the scores on another, already established, a test administered at the same time, or to some other valid criterion available at the same time. Example, a new simple test is to be used in place of an old cumbersome one, which is considered useful, measurements are obtained on both at the same time. Logically, predictive and concurrent validation are the same, the term concurrent validation is used to indicate that no time elapsed between measures.

- **Construct Validity**: construct validity is the degree to which a test measures an intended hypothetical construct. Many times psychologists assess/measure abstract attributes or constructs. The process of validating the interpretations about that construct as indicated by the test score is constructed validation.

- **Content Validity**: content validity is the extent to which a measuring instrument provides adequate coverage of the topic under study. If the instrument contains a representative sample of the universe, the content validity is good. Its determination is primarily judgemental and intuitive. It can also be determined by using a panel of persons who shall judge how well the measuring instrument meets the standards, but there is no numerical way to express it (Kothari, 2004).

The aforementioned criteria were considered in the course of validating the research instrument used for this study. The validity of the questionnaire used for this study was carried out ten (10) postgraduate lecturers in the Department of Building including the two (2) supervisors for this study who are experts in maintenance management. Furthermore, a senior

member of the maintenance unit of the Works and Physical Planning Department, University of Lagos was involved in the content validity of the research instrument.

3.14.4 Reliability

The reliability of a research instrument simply refers to the degree to which the instrument is consistent or its repeatability over time (Melorose *et al*., 2015). This means that measurements are reliable to the extent to which they are repeatable and that any random influence which tends to make measurements different from occasion to occasion or circumstance to circumstance is a source of measurement error (Anastasiadou, 2011). Therefore, reliability is the degree to which a test consistently measures whatever it measures.

Creswell (2012) opines that five (5) procedures are available for evaluating research instrument's reliability. Furthermore, researchers can use any one or more of the five available procedures to examine an instrument's reliability. The procedures can be distinguished by the number of times the instrument is administered, the number of versions of the instrument administered by researchers, and the number of individuals who make an assessment of information. The procedures include the test-retest reliability, alternative forms reliability, alternative forms and test-retest reliability, interrater reliability and internal consistency reliability.

- **Test-retest Reliability:** The test-retest reliability procedure examines the extent to which scores from one sample are stable over time from one test administration to another. To determine this form of reliability, the researcher administers the test at two different times to the same participants at a sufficient time interval. If the scores are reliable, then they will relate (or will correlate) at a positive, reasonably high level, such as 0.6. This approach has the advantage of requiring only one form of the

instrument; however, an individual's scores on the first administration of the instrument may influence the scores on the second administration.

- **Equivalent-Forms or Alternate-Forms Reliability:** this procedure involves using two instruments that are identical in every way except for the actual items included. This procedure is used when it is likely that test takers will recall responses made during the first session and when alternate forms are available. The scores from the two instrument are then correlated. The obtained coefficient is called the coefficient of stability or coefficient of equivalence. The advantage of this approach is that it allows you to see if the scores from one instrument are equivalent to scores from another instrument, for two instruments intended to measure the same variables.

- **Split-Half Reliability:** the split-half reliability requires only one administration and it is especially appropriate when the test is very long. The most commonly used method to split the test into two is using the odd-even strategy. The split-half technique can be used when the measuring tool has many similar questions or statements to which the participant can respond. The instrument is administered and the results are separated by item into even and odd numbers or into randomly selected halves. When the two halves are correlated, if the results of the correlation are high, the instrument is said to have high reliability in an internal consistency sense. The high correlation implies similarity (or homogeneity) among the items. The potential for incorrect inferences about high internal consistency exists when the test contains many items which inflates the correlation index. The Spearman-Brown correction formula is used to adjust for the effect of test length and to estimate reliability of the whole test

- **Interrater Reliability:** interrater reliability is a procedure used when making observations of behaviour. It involves observations made by two or more individuals of an individual's or several individuals' behaviour. The observers record their scores of the behaviour and then compare scores to see if their scores are similar or different. Because this method obtains observational scores from two or more individuals, it has the advantage of negating any bias that any one individual might bring to scoring. It has the disadvantages of requiring the researcher to train the observers and requiring the observers to negotiate outcomes and reconcile differences in their observations, something that may not be easy to do.

- **Internal Consistency Reliability:** Determining how all items on the test relate to all other items. The internal consistency is usually measured with Cronbach's alpha, a statistic calculated from the pairwise correlations between items. Internal consistency ranges between zero and one. A commonly accepted rule of thumb is that the range of α of 0.6-0.7 indicates acceptable reliability, and 0.8 or higher indicates good reliability. The goal in designing a reliable instrument is for scores on similar items to be related (internally consistent), but for each to contribute some unique information as well.

This study employed the internal consistency reliability procedure to test the reliability of the research instruments used for this study. The internal consistency reliability for the set of research instrument used for the pilot of this study was evaluated using the Cronbach Alpha. Cronbach's α is a coefficient of consistency and measures how well a set of variables or items measures a single, unidimensional latent construct.

Mathematically, the Cronbach's α is computed using the formula:

$$\alpha = \frac{N}{N-1}\left(1 - \frac{\sum_{i=1}^{N}\sigma_{Y_i}^2}{\sigma_X^2}\right) \quad \text{.....3.10}$$

Where:

N is the number of components (items or testlets), σ_X^2 is the variance of the observed total test scores, and $\sigma_{Y_i}^2$ is the variance of component i.

The results of the Cronbach Alpha for the various variables of the research instruments are as follows:

Table 3.3: Reliability test results for constructs measuring the condition of building fabrics in maintenance staff questionnaire

Variables	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Frames	41.44	80.13	0.60	0.95
Upper floors	41.56	78.93	0.76	0.94
Roofs	42.00	79.07	0.64	0.95
Stairs	41.81	72.70	0.81	0.94
External walls	41.44	75.46	0.90	0.94
Windows and External Doors	41.50	73.60	0.86	0.94
Internal walls and partitions	41.38	75.85	0.78	0.94
Internal doors	41.56	72.66	0.90	0.94

Variables	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Wall finishes	41.75	81.93	0.57	0.95
Floor finishes	41.50	76.53	0.74	0.94
Ceilings	41.50	77.07	0.77	0.94
Nettings	41.69	77.16	0.71	0.94
Cronbach's Alpha	**0.95**			
Number of items	**12**			
Number of samples	**16**			

The reliability test for the variables measuring the condition of building fabrics of tertiary institution buildings in the maintenance staff questionnaire using the standardised Cronbach's Alpha was found to be 0.95. This value is greater than the acceptable threshold of 0.70 (Clark & Creswell, 2015; Aasland, 2008; Conroy, 2006) and thus shows that variables are correlated to each other based on the responses provided by the respondents. The 0.95 Cronbach's Alpha value obtained for these sets of variables implies that there is internal consistency of responses from the respondents and thus the variables satisfy the requirements of reliability assumptions.

Table 3.4: Reliability test results for constructs measuring the condition of building services in maintenance staff questionnaire

Variables	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Sanitary appliances	40.83	47.06	0.88	0.90

Variables	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Services equipment	40.67	47.88	0.93	0.90
Disposal installation	40.58	49.90	0.82	0.91
Water installation	40.42	48.99	0.72	0.91
Electrical installation	40.42	48.08	0.80	0.91
Gas Installation	41.00	50.73	0.46	0.93
Lifts and conveyor installation	40.92	47.54	0.55	0.93
Protection installation	40.75	50.93	0.58	0.92
Drainages	40.83	45.79	0.80	0.91
External Services	40.67	49.33	0.79	0.91
Ventilation system	40.42	52.08	0.46	0.92
Cronbach's Alpha	**0.92**			
Number of items	**11**			
Number of samples	**12**			

The reliability test for the variables measuring the condition of building services of tertiary institution buildings in the maintenance staff questionnaire using the standardised Cronbach's Alpha was found to be 0.92. This value is greater than the acceptable threshold of 0.70 (Clark & Creswell, 2015; Aasland, 2008; Conroy, 2006) and thus shows that variables are correlated to each other based on the responses provided by the respondents. The 0.92 Cronbach's Alpha value obtained for the eleven (11) sets of variables implies that there is internal consistency

of responses from the respondents and thus the variables satisfy the requirements of reliability assumptions.

Table 3.5: Reliability test results for constructs measuring the condition of building environment in maintenance staff questionnaire

Variables	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
General sanitation of the environment	7.65	3.96	0.82	0.89
Lawns and Gardens	7.74	3.84	0.82	0.88
Car park and parking lots	7.74	3.29	0.85	0.86
Cronbach's Alpha	**0.92**			
Number of items	**3.00**			
Number of samples	**23**			

The reliability test for the variables measuring the condition of building environment of tertiary institution buildings in the maintenance staff questionnaire using the standardised Cronbach's Alpha was found to be 0.92. This value is greater than the acceptable threshold of 0.70 (Clark & Creswell, 2015; Aasland, 2008; Conroy, 2006) and thus shows that variables are correlated to each other based on the responses provided by the respondents. The 0.92 Cronbach's Alpha value obtained for the three (3) sets of variables implies that there is internal consistency of responses from the respondents and thus the variables satisfy the requirements of reliability assumptions.

Table 3.6: Reliability test results for constructs measuring the condition of building aesthetics in maintenance staff questionnaire

Variables	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Fittings and furnishings	11.53	3.60	0.88	0.80
Internal painting	11.58	4.15	0.82	0.83
External painting	11.47	5.04	0.56	0.92
External cornices on facades	11.84	3.92	0.77	0.85
Cronbach's Alpha	**0.89**			
Number of items	**4**			
Number of samples	**19**			

The reliability test for the variables measuring the condition of building aesthetics of tertiary institution buildings in the maintenance staff questionnaire using the standardised Cronbach's Alpha was found to be 0.89. This value is greater than the acceptable threshold of 0.70 (Clark & Creswell, 2015; Aasland, 2008; Conroy, 2006) and thus shows that variables are correlated to each other based on the responses provided by the respondents. The 0.89 Cronbach's Alpha value obtained for the four (4) sets of variables imply that there is internal consistency of responses from the respondents and thus the variables satisfy the requirements of reliability assumptions.

Table 3.7: Reliability test results for constructs measuring the level of use of insourcing and outsourcing practice in maintenance staff questionnaire

Variables	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Civil and building fabrics maintenance	19.00	27.82	0.74	0.83
Air-conditioners maintenance	19.42	33.54	0.37	0.85
Generator maintenance	19.50	31.55	0.67	0.84
Water system and borehole maintenance	19.58	32.99	0.49	0.85
Water treatment plant maintenance	19.58	33.54	0.41	0.85
Lift system maintenance	19.00	30.55	0.61	0.84
CCTV cameras maintenance	19.00	31.27	0.53	0.85
Plumbing system maintenance	19.67	33.15	0.51	0.85
Fire protection systems	19.33	32.61	0.50	0.85
Sewage evacuation and disposal	19.17	29.61	0.79	0.83
Cleaning services	19.25	34.20	0.22	0.86
Refuse disposal	19.33	32.06	0.46	0.85
Fumigation services	19.33	30.79	0.75	0.83

Variables	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Landscape and gardens	19.67	36.42	0.02	0.87
Cronbach's Alpha	**0.857**			
Number of items	**14**			
Number of samples	**12**			

The reliability test for the variables measuring the level of use of insourcing and outsourcing maintenance practice in the maintenance staff questionnaire using the standardised Cronbach's Alpha was found to be 0.86. This value is greater than the acceptable threshold of 0.70 (Clark & Creswell, 2015; Aasland, 2008; Conroy, 2006) and thus shows that variables are correlated to each other based on the responses provided by the respondents. The 0.86 Cronbach's Alpha value obtained for the four (4) sets of variables imply that there is the internal consistency of responses from the respondents and thus the variables satisfy the requirements of reliability assumptions.

Table 3.8: Reliability test results for constructs measuring the factors influencing insourcing decision of practice in maintenance staff questionnaire

Variables	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Timing & coordination of the activity is critical to the institution	32.74	37.29	0.33	0.80

Variables	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Reputation of the institution could be damaged by subcontractor actions	33.00	33.55	0.67	0.76
The activities are viewed as core to the institution	33.04	36.68	0.31	0.80
Difficult to find subcontractors with compatible organizational culture	33.91	28.72	0.81	0.73
Subcontractor could act in their own interest to the detriment of the institution	33.57	34.17	0.48	0.78
It is difficult to find trustworthy subcontractors	33.52	34.44	0.51	0.78
Economies of scale can be achieved in-house	32.96	41.50	-0.08	0.83
Unpredictable activities are difficult to contract for	33.13	34.48	0.43	0.79
Difficulty in appraising subcontractor’s performance	33.96	31.41	0.57	0.77

Variables	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Subcontractors may feel exposed to potential loss of investment.	33.96	30.23	0.64	0.76
Cronbach's Alpha	**0.799**			
Number of items	**10**			
Number of samples	**23**			

The reliability test for the variables measuring the factors influencing decision to insource maintenance activities as presented in the maintenance staff questionnaire using the standardised Cronbach's Alpha was found to be 0.80. This value is greater than the acceptable threshold of 0.70 (Clark & Creswell, 2015; Aasland, 2008; Conroy, 2006) and thus shows that variables are correlated to each other based on the responses provided by the respondents. The 0.80 Cronbach's Alpha value obtained for the four (4) sets of variables imply that there is the internal consistency of responses from the respondents and thus the variables satisfy the requirements of reliability assumptions.

Table 3.9: Reliability test results for constructs measuring the factors influencing outsourcing decision of practice in maintenance staff questionnaire

Variables	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Focus on core activities	147.94	300.73	0.36	0.90

Variables	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Access to world class capabilities	148.00	302.53	0.31	0.90
Freeing resources for core activities	148.31	299.03	0.43	0.90
Accelerate re-engineering benefits	148.06	294.86	0.55	0.90
Risk sharing with contractors	147.94	305.53	0.26	0.91
Lack of internal resources for a service	148.50	286.93	0.46	0.90
Improve flexibility to the changing market dynamics	147.88	286.92	0.65	0.90
Strategic alliance with contractors	148.31	289.16	0.71	0.90
Regulations governing outsourcing practices	148.63	301.05	0.32	0.90
Save management time	148.19	297.63	0.31	0.91
Reduce management load	148.00	293.60	0.53	0.90
Need for specialised management	148.31	290.50	0.54	0.90
Increase the speed of implementation	147.88	295.05	0.53	0.90

Variables	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Function difficult to manage	148.44	282.00	0.63	0.90
Safety management	148.19	296.70	0.45	0.90
Consolidation and decentralisation	148.13	294.65	0.46	0.90
Achieve flexibility with changing technology	147.69	294.63	0.63	0.90
Initiate innovative ideas and techniques	148.06	303.40	0.23	0.91
Improve the technology for competitive advantage	147.88	302.78	0.35	0.90
Technology requirements uncertainty	148.19	290.96	0.55	0.90
Need for specialised expertise	147.50	305.47	0.38	0.90
Acquire new skills or technical knowledge	147.50	304.93	0.33	0.90
Save the overall cost	147.94	295.26	0.54	0.90
Reduce the labour and operating cost	147.75	295.93	0.67	0.90
Transform fixed cost into variable costs	148.19	298.03	0.45	0.90

Variables	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Improve the cash flow	147.81	299.63	0.53	0.90
Cash infusion	147.81	287.50	0.77	0.90
Make capital funds more available for core activities	147.81	295.36	0.62	0.90
Increase the economic efficiency	147.69	297.96	0.57	0.90
Improve service quality	147.75	308.73	0.14	0.91
Improve quality requirements	147.94	290.46	0.50	0.90
Achieve high quality of service for competitive advantage	147.69	300.50	0.46	0.90
Procure higher reliability and competency	147.56	301.33	0.49	0.90
Complexity of function	148.25	304.33	0.18	0.91
Function integration and structure	148.50	293.47	0.45	0.90
Lack of spare parts	148.69	305.83	0.09	0.91
Function difficult to control	149.00	297.47	0.34	0.90
Lack in equipment /tools availability	148.44	299.60	0.24	0.91

Variables	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Cronbach's Alpha	**0.906**			
Number of items	**38**			
Number of samples	**16**			

The reliability test for the variables measuring the factors influencing decision to outsource maintenance activities as presented in the maintenance staff questionnaire using the standardised Cronbach's Alpha was found to be 0.91. This value is greater than the acceptable threshold of 0.70 (Clark & Creswell, 2015; Aasland, 2008; Conroy, 2006) and thus shows that variables are correlated to each other based on the responses provided by the respondents. The 0.91 Cronbach's Alpha value obtained for the thirty-eight (38) set of variables implies that there is the internal consistency of responses from the respondents and thus the variables satisfy the requirements of reliability assumptions.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS, AND DISCUSSION OF RESULTS

4.1 Introduction

This chapter presents the result and the analysis of the data obtained through the copies of questionnaires administered. The analysed data was used to test the research hypotheses. In achieving this purpose, both descriptive and inferential statistics were used to analyse the data and differences and relationships were obtained from the analysed data. The data sourced for this study were processed using Statistical Package for the Social Sciences (SPSS) version 23.0.

In analysing the data and presenting the results of this study, various descriptive and inferential statistic tools were used. The descriptive statistics tools employed comprises frequency tables, mean scores, and bar charts. In addition, to determine the differences or relationships between the variables of the study, inferential statistic tools such as independent samples t-test, paired samples t-test and analysis of variance were used to establish inferences for this study. Resulting implications of both the descriptive and inferential statistics are presented in succession and in order to address the objectives of this study.

4.2 Response Rate to Survey Instrument

The primary data used for this study was obtained through a questionnaire survey. Questionnaires were administered to maintenance managers, maintenance technical officers and the users of tertiary institution buildings within the study area. Table 4.1 shows the details

of the number of questionnaires administered in the tertiary institutions across the six states of South-West, Nigeria and their corresponding rate of returns.

Table 4.1: Survey Rate of Returns

State	Maintenance manager				Maintenance technical staff				Building users			
	SS	NA	NR	RR	SS	NA	NR	RR	SS	NA	NR	RR
LAGOS	6	6	6	100%	29	31	29	94%	54	60	55	92%
ONDO	4	4	4	100%	12	12	12	100%	36	40	38	95%
OYO	5	5	5	100%	19	20	19	95%	45	50	47	94%
OGUN	17	17	17	100%	61	72	65	65%	152	168	161	96%
OSUN	7	7	7	100%	25	27	26	96%	62	70	67	96%
EKITI	4	4	4	100%	14	14	14	100%	36	40	38	95%
TOTAL	**43**	**43**	**43**		**160**	**176**	**165**		**385**	**428**	**406**	

Note: SS= Sample size, NA= Number of questionnaires administered, NR = Number of questionnaires retrieved, RR= Response rate (%).

Table 4.1 shows that all the forty-three (43) questionnaires administered to the maintenance managers were completed and returned representing 100% response rate. In addition, one hundred and sixty-five (165) questionnaires out of the one hundred and seventy-six (176) questionnaires administered to the maintenance technical staff were duly completed and returned representing 94% response rate. In most of the public tertiary institutions with considerable large infrastructure, the maintenance manager's questionnaire was completed by the director of works and physical planning. For institutions with the relatively small maintenance department, the maintenance manager's questionnaire was completed by the most superior member of staff in the department or unit. In addition, the questionnaires for

maintenance technical staff were completed by middle-level maintenance officers who are saddled with supervisory roles across the various sections within the maintenance department or unit. This implies that the data from the sets of questionnaires from the maintenance departments of the various institutions can be relied upon as reflecting the maintenance management practices across the various institutions.

Furthermore, Table 4.1 shows that a total of four hundred and six (406) questionnaires were duly completed and retreived from the building users out of the four hundred and twenty-eight questionnaires that were administered.

The users of the building constituting this sample comprised of academic staff, non-academic staff, and students of the various tertiary institutions. This implies that the respondents were expected to be conversant with the operation and maintenance activities in the buildings and the corresponding condition of the buildings. They were therefore capable of providing responses to maintenance management related questions about the buildings in their institutions.

Table 4.2: Category of respondents

Category of respondent	Frequency	Percentage
Building user	406	66.1
Maintenance technical staff	165	26.9
Maintenance Manager	43	7.0
Total	614	100.0

Table 4.2 shows that a total of six hundred and fourteen (614) respondents participated in this survey comprising four hundred and six (406) building users representing about 66% of the total respondents, one hundred and sixty-five (165) maintenance technical staff representing about 27% of the respondents and forty-three (43) maintenance managers representing 7% of the respondents. This implies that responses were received across the strata of stakeholders in the various tertiary institutions on maintenance management and as such the data obtained represents a cross-section of opinions of these stakeholders on maintenance management practices in their respective institutions of higher learning.

4.3 Demographic Data of Respondents

This section shows the characteristics of respondents that participated in this study. The analysis covers basic information about the respondents comprising the name of the respondents' institution, type of institution and respondents' gender.

4.3.1 Institution of Respondents

Table 4.3 shows the details of the various institutions of the respondents for this study.

Table 4.3: Name of respondents' institution

Name of Respondents' Institution	Frequency	Percentage
Lagos State		
University of Lagos	14	2.3
National Open University	12	2.0
Lagos State University	15	2.4

Name of Respondents' Institution	Frequency	Percentage
Caleb University	6	1.0
Yaba College of Technology	15	2.4
Lagos State Polytechnic	13	2.1
Ondo State		
Federal University of Technology Akure	10	1.6
Ondo University of Medical Sciences	11	1.8
Achievers University Owo	3	.5
Rufus Giwa Polytechnic Owo	10	1.6
Oyo State		
University of Ibadan	24	3.9
Ladoke Akintola University of Technology	12	2.0
Ibadan City Polytechnic	9	1.5
The Polytechnic, Ibadan	16	2.6
The Ibarapa Polytechnic, Eruwa	15	2.4
Ogun State		
Federal University of Agriculture Abeokuta	20	3.3
Olabisi Onabanjo University	20	3.3
Tai Solarin University	20	3.3
Covenant University	20	3.3
Bells University	16	2.6
Christopher University	19	3.1
Babcock University	20	3.3
Chrisland University	18	2.9
Crescent University	20	3.3

Name of Respondents' Institution	Frequency	Percentage
Mountain Top University	19	3.1
Federal Polytechnic Ilaro	20	3.3
Gateway Polytechnic Sapade	20	3.3
D.S Adegbenro Polytechnic	16	2.6
Moshood Abiola Polytechnic Abeokuta	20	3.3
Abraham Adesanya Polytechnic	20	3.3
Ogun State Institute of Technology	18	2.9
Osun State		
Obafemi Awolowo University	10	1.6
University of Osun State	10	1.6
Redeemers University	9	1.5
Adeleke University	10	1.6
Bowen University	9	1.5
Crawford University	12	2.0
Federal Polytechnic Ede	10	1.6
Wolex Polytechnic Iwo	16	2.6
Ekiti State		
Federal University Oye-Ekiti	10	1.6
Ekiti State University	9	1.5
Afe Babalola Private University	10	1.6
Federal Polytechnic Ado-Ekiti	8	1.3
Total	614	100.0

Table 4.3 shows the names of the institutions of the respondents that responded to the survey. The analysis revealed that the generality of the respondents were from forty-three tertiary institutions spread across the six states of the South-West region of Nigeria. Furthermore, the respondents cut across federal, state and private tertiary institutions respectively. The implication of this is the data collected provides a robust information on maintenance sourcing practices in the South-West region which can be generalised.

4.3.2 Gender of Respondents

Table 4.4 shows the results of gender composition of the respondents that participated in this survey.

Table 4.4: Gender of Respondents

Gender of respondent	Frequency	Percentage
Male	412	67.1
Female	202	32.9
Total	614	100.0

Table 4.4 shows that about 67% of the respondents were male while about 33% were female. This shows that the distribution gives an adequate representation of male and female respondents.

4.3.3 Age of Respondents

Table 4.5 shows the age of respondents that participated in this survey.

Table 4.5: Age of Respondents

Age of respondent	Frequency	Percentage
21 - 30 years	107	17.4
31 - 40 years	327	53.3
41 - 50 years	160	26.1
Above 50 years	20	3.3
Total	614	100.0

Table 4.5 shows that the age range of about 17% of the respondents was between 21 to 30 years old, about 53% were between 31 to 40 years old, about 26% were between 41 to 50 years old and about 3% were above 50 years old. This implies that the respondents are generally mature people who are capable of providing useful responses to the research instrument.

4.3.4 Years of Working Experience

Table 4.6 shows the length of time the respondents have spent working in their respective institutions.

Table 4.6: Years of Working Experience

Years of working experience in the institution	Frequency	Percentage
Less than 5 years	157	39.9
6 - 10 years	137	34.9
11 - 15 years	66	16.8
16 - 20 years	24	6.1

Years of working experience in the institution	Frequency	Percentage
21 - 25 years	5	1.3
Above 25 years	4	1.0
Total	393	100.0

The results in table 4.6 show that about 60% of the respondents have spent over 5 years working in their respective institutions. This implies that majority of the respondents are conversant with the maintenance management practices used for their respective buildings and are capable of providing valuable responses to the research instrument.

4.3.5 Level of Education of Respondents

Maintenance staff that participated in the survey were asked to indicate their level of education. The responses were analysed and the result is shown in Figure 4.1 below:

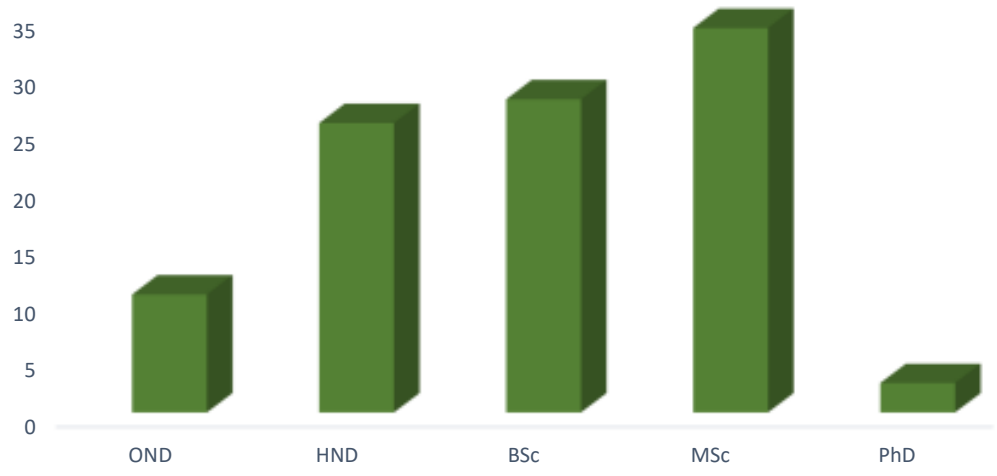

Figure 4.1: Level of Education of Respondents

Figure 4,1 shows that about 90% of the respondents has minimum of Higher National Diploma certificate. This imply that the resondents have adeqaute level of education to comprehend the questions posed to them and provide reliable responses to the questions.

4.3.6 Professional Affiliation of Maintenance Staff

Information on the professional affiliation of maintenance staff that participated in the survey were collected and analysed. The result of the analysis is shown in Figure 4.2 below:

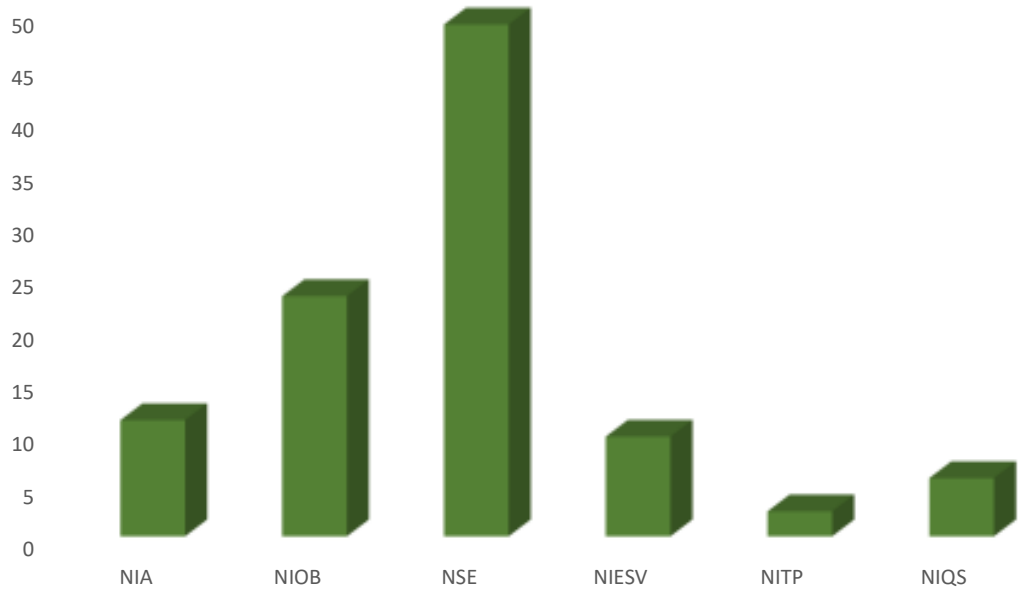

Figure 4.2: Professional Affliation of Mainteannce Staff

Figure 4.2 shows that although the maintenance staff had different professional affliations, about 50% were affliated to the Nigerian Society of Engineers (NSE). This suggests that majority of the maintenance staff were engineers. This implies that the respondents are most likely hands-on and conversant with maintenance managementof systems within the building. Hence, their ability to provide valuable responses the questionnaires administered to them.

4.4 Level of Use of Insourcing and Outsourcing Practices

In the course of this study, the maintenance managers of each of the forty-three tertiary institutions were asked to indicate the sourcing practice(s); i.e. insourcing or/and outsourcing practice(s) that they use in executing maintenance activities in their respective institutions. The managers were asked to provide their responses for a range of pre-defined maintenance services. The maintenance managers rated the level of use of each of the maintenance sourcing practices on a scale of 1 to 5. The mean of the responses was calculated for each of the maintenance services. The calculated mean score for the level of use of insourcing or/and outsourcing practice(s) were interpreted using the scale $1.00 \leq MS \leq 1.49$ to represent never used, $1.50 \leq MS \leq 2.49$ to represent rarely used, $2.50 \leq MS \leq 3.49$ to represent sometimes used, $3.50 \leq MS \leq 4.49$ to represent often used and $4.50 \leq MS \leq 5.00$ represent always used sourcing option. The analysis of the responses provided by the maintenance managers is shown in table 4.7.

Table 4.7: Level of use of maintenance sourcing practices

Maintenance Services	N	Insourcing practice			Outsourcing practice		
		MLU	Rank	Remark	MLU	Rank	Remark
Building fabrics maintenance							
Building fabrics (Roofs, floors, windows, doors, stairs etc.)	43	3.61	13	OU	3.68	5	OU
Building services maintenance							
Lift systems	43	2.59	21	SU	3.50	12	OU
Air-conditioners	43	3.75	11	OU	3.66	6	OU
Generators	43	3.67	12	OU	3.87	1	OU
Electrical systems	43	4.09	2	OU	3.39	15	SU

Maintenance Services	N	Insourcing practice			Outsourcing practice		
		MLU	Rank	Remark	MLU	Rank	Remark
Plumbing systems	43	3.96	6	OU	3.01	21	SU
Boreholes	43	3.96	6	OU	3.35	16	SU
Internet services installations	43	3.47	18	SU	3.59	8	OU
Intercom systems	43	3.41	19	SU	3.43	13	SU
CCTV systems	43	2.88	20	SU	3.73	4	OU
Water treatment plant	43	3.50	16	OU	3.28	18	SU
Fire protection systems (fire extinguishers, hose reel, etc.)	43	3.48	17	SU	3.64	7	OU
Building Environmental Services							
Office cleaning	43	4.10	1	OU	3.42	14	SU
Classrooms cleaning	43	4.07	4	OU	3.52	11	OU
Common areas cleaning (Toilets, corridors, stairs, etc.)	43	4.05	5	OU	3.54	10	OU
Landscape and Gardens	43	4.08	3	OU	3.25	20	SU
Refuse and waste disposal	43	3.93	8	OU	3.58	9	OU
Fumigation services	43	3.87	9	OU	3.26	19	SU
Sewage evacuation and disposal	43	3.84	10	OU	3.31	17	SU
Building Aesthetics Services							
Internal painting	43	3.52	15	OU	3.78	3	OU
External painting	43	3.55	14	OU	3.87	1	OU

Note MLU= Mean level of use, OU = Often used, SU = Sometimes used

Table 4.7 shows the sourcing practice(s) adopted by maintenance managers of tertiary institutions in executing maintenance services. The result reveals that 16 (sixteen) of the maintenance services were oftentime executed using insourcing practice while 12 (twelve) of the services were often executed using outsourcing practice respectively. The result implies that 9 (nine) of the maintenance services are oftentimes executed using only in-sourcing maintenance practice, 5 (five) of maintenance services are oftentimes executed using only outsourcing practice while 7 (seven) of the maintenance services are oftentimes executed using the combination of insourcing and outsourcing practices in a hybrid or co-sourcing arrangement.

Maintenance services that are often time insourced in tertiary institutions include; office cleaning (4.10), electrical systems maintenance (4.09), landscape and garden maintenance (4.08), classrooms cleaning (4.07), common areas cleaning (4.05), plumbing systems maintenance (3.96), borehole maintenance (3.96), refuse and waste disposal (3.93), fumigation services (3.87), sewage evacuation and disposal (3.84), air conditioners maintenance (3.75), generators maintenance (3.67), building fabrics maintenance (3.61), external painting (3.55), water treatment plant maintenance (3.50) and internal painting (3.52).

Table 4.7 further shows that maintenance activities that are often times outsourced in tertiary institutions within the study area include; generators maintenance (3.87), external painting maintenance (3.87), internal painting maintenance (3.78) , Closed Circuit Television (CCTV) system maintenance (3.73), building fabric maintenance (3.68), air conditioners maintenance (3.66), fire protection system maintenance (3.64), internet services maintenance (3.59), refuse

and waste disposal (3.58), common area cleaning (3.54), classroom cleaning (3.52) and lift systems maintenance (3.50).

It was observed from the results in Table 4.7 that the maintenance of critical building services such as the maintenance of lift system, CCTV systems, internat services and fire protection systems are often times outsourced while maintenance of building interior services such as the maintenance of electrical systems, plumbing and borehole systems are often in-sourced. This implies that both insourcing and outsourcing practices are used interchangeably in executing maintenance services in tertiary institutions. The result suggests that building elements or services whose maintenance requires some form of specialised skills are often outsourced while those maintenance services with potential security challenge such as office cleaning and plumbing system maintenance are often in-sourced.

Although the result of this study shows that cleaning services in tertiary institutions are oftentimes carried out using co-sourcing, it however supports the position of Sang (2010) that cleaning is one of the three most outsourced services in institutions with catering and security services completing the list from facilities management perspective. Sang (2010) further explains that institutions have recorded success in the outsourcing of cleaning services with benefits accruing in cost reduction and time-saving. The potential benefits of outsourcing cleaning services may be the reason for the decision of some tertiary instutitons to outsource cleaning services.

4.4.1 Test of Hypothesis 1

Null Hypothesis (H_0): There is no significant difference between the level of use of insourcing and outsourcing practices in the maintenance management of tertiary institution buildings in South-West, Nigeria.

Alternative Hypothesis (H_1): There is significant difference between the level of use of insourcing and outsourcing practices in the maintenance management of tertiary institution buildings in South-West, Nigeria.

The hypothesis was tested using Wilcoxon signed-rank test. The rule for accepting or rejecting the hypothesis is that the hypothesis is accepted when the p-value > 0.05, while the hypothesis is rejected when the p-value ≤ 0.05 (Field, 2009).

Table 4.8: Wilcoxon signed-rank test for the level of use of insourcing and outsourcing maintenance services in tertiary institutions in South-West, Nigeria.

Wilcoxon signed-rank test	BFO - BFI	BSO - BSI	BEO - BEI	BAO - BAI
Z	-.832	-1.415	-4.294	-.739
p-value	.405	.157	.000	.460
Remark	NS	NS	S	NS

Note: Significant at *p≤0.05, BFO=Outsourced building fabrics, BFI= Insourced building fabrics, BSO=Outsourced building services, BSI=Insourced building services, BEO=Outsourced building environmental services, BEI=Insourced building environmental services, BAO=Outsourced building aesthetics, BAI=Insourced building aesthetics, NS=Not Significant, S=Significant.

Table 4.8 shows that the difference in the level of use of insourcing and outsourcing practices between the categories of maintenance services is not significant for building fabrics (p=

0.405), building services (p= 0.157) and building aesthetics maintenance (p= 0.406). Therefore the null hypothesis was accepted for the three categories of services. The result, however, shows that the level of use of insourcing and outsourcing maintenance practices for building environmental services was significant (p=0.000) implying a rejection of the null hypothesis for the category. The raw output of the Wilcoxon signed-rank test is attached as appendix to this thesis. The implication of the results is that although insourcing and outsourcing practices were interchangeably used for maintenance services in tertiary institutions, environmental and janitorial services in tertiary institutions were predominatly outsourced.

The result of this study concurs with the findings of Ikediashi *et al*. (2012) where it was reported that the use of outsourcing practice is gaining popularity amongst institutions for the execution of facilities management services to complement the traditional insourcing practice. This implies that policy makers in tertiary institutions are adopting current business practices in order to harness the potential economic benefits of such practices. Lateef, Khamidi and Idrus (2010) explain further that tertiary institutions usually combine the use of insourcing and outsourcing in executing maintenance services in order to leverage on manpower synergies between the institution and the contracting firm.

4.5 Factors Influencing the Decision to Insource or Outsource Building Maintenance Services in Tertiary Institution in South-West, Nigeria.

Based on extensive review of the literature, the taxonomy of 49 variables influencing decision to insource or outsource services was developed and presented to the respondents to evaluate. The respondents were asked to rate the level of influence that they perceive each of the factors have on insourcing and outsourcing decisions respectively. A 5 point Likert scale was

provided to the respondents as the means of evaluating the factors. The scale ranges from; 1=not at all influential to 5=extremely influential. The relative influence index (RII) score of each of the factors on insourcing and outsourcing decisions were calculated using the RII formula stated earlier in equation 3.4. Table 4.9 shows the descriptive statistics results for the factors. The calculated RII values were interpreted using the scale RII $\geq$ 0.76 means most significant, 0.67 $\leq$ RII $\leq$ 0.75 means significant, 0.45 $\leq$ RII $\leq$ 0.66 means less significant and RII $\leq$ 0.44 means not significant (Waziri & Vanduhe, 2013; Magutu & Kamweru, 2015).

Table 4.9: Factors influencing decision to insource or outsource maintenance services in tertiary institutions

Factors influencing maintenance sourcing decision	Insourcing			Outsourcing		
	RII	Rank	Remark	RII	Rank	Remark
Strategic Factors						
Developing internal staff	0.93	1	MS	0.31	48	NS
Maintenance is core to institution	0.9	2	MS	0.36	45	NS
Potential damage to reputation of institution	0.73	9	S	0.35	47	NS
Accelerate re-engineering benefits	0.69	16	S	0.68	31	S
Regulations governing outsourcing practices	0.45	25	LS	0.64	38	LS
Improve flexibility to the changing market dynamics	0.43	32	NS	0.67	35	S
Strategic alliance with contractors	0.37	43	NS	0.91	2	MS
Freeing resources for core activities	0.36	44	NS	0.68	30	S

Factors influencing maintenance sourcing decision	Insourcing			Outsourcing		
	RII	Rank	Remark	RII	Rank	Remark
Risk sharing with contractors	0.35	46	NS	0.66	36	LS
Focus on core activities	0.27	48	NS	0.71	19	S
Access to world class capabilities	0.27	49	NS	0.7	25	S
Management Factors						
Difficulty in appraising subcontractor's performance	0.89	3	MS	0.39	39	NS
Difficulty in getting trustworthy subcontractors	0.88	4	MS	0.2	49	NS
Timing and coordination of maintenance activities	0.81	5	MS	0.37	41	NS
Potential conflict of interest between subcontractor and institution	0.79	6	MS	0.36	42	NS
Difficulty of getting subcontractors with compatible organisation culture	0.76	7	MS	0.35	46	NS
Safety management	0.72	14	S	0.7	23	S
Consolidation and decentralisation	0.7	15	S	0.68	29	S
Function difficult to manage and control	0.68	17	S	0.79	10	MS
Increase the speed of implementation	0.62	20	LS	0.72	14	S
Reduce management load	0.43	30	NS	0.71	17	S
Save management time	0.43	35	NS	0.71	20	S
Need for specialised management	0.36	45	NS	0.91	3	MS

Factors influencing maintenance sourcing decision	Insourcing			Outsourcing		
	RII	Rank	Remark	RII	Rank	Remark
Economic Factors						
Economies of scale	0.75	8	S	0.36	44	NS
Potential loss of investments	0.64	19	LS	0.36	43	NS
Cash infusion	0.53	21	LS	0.69	26	S
Accountability	0.53	22	LS	0.89	4	MS
Transform fixed cost into variable costs	0.45	23	LS	0.67	34	S
Increase the economic efficiency	0.44	26	NS	0.72	13	S
Improve the cash flow	0.44	28	NS	0.68	28	S
Make capital funds more available for core activities	0.43	29	NS	0.72	15	S
Overall maintenance cost reduction	0.43	36	NS	0.87	6	MS
Quality Factors						
Improve process responsiveness and cycle time	0.45	24	LS	0.67	32	S
Procure higher reliability and competency	0.43	33	NS	0.84	8	MS
Improve quality requirements	0.42	37	NS	0.84	7	MS
Improve service quality	0.42	38	NS	0.83	9	MS
Achieve high quality of service for competitive advantage	0.42	40	NS	0.74	11	S
Technological Factors						

Factors influencing maintenance sourcing decision	Insourcing			Outsourcing		
	RII	Rank	Remark	RII	Rank	Remark
Initiate innovative ideas and techniques	0.73	10	S	0.72	16	S
Improve the technology for competitive advantage	0.73	11	S	0.71	18	S
Acquire new skills or technical knowledge	0.42	39	NS	0.72	12	S
Need for specialised expertise	0.39	41	NS	0.92	1	MS
Achieve flexibility with changing technology	0.38	42	NS	0.71	21	S
Technology requirements uncertainty	0.66	18	LS	0.65	37	LS
Function Characteristics Factors						
Complexity of function	0.73	12	S	0.7	24	S
Difficulty in contracting unpredictable activities	0.72	13	S	0.38	40	NS
Lack of spare parts	0.44	27	NS	0.67	33	S
Lack in equipment /tools availability	0.43	31	NS	0.69	27	S
Function integration and structure	0.43	34	NS	0.7	22	S
Lack of internal resources for a service	0.34	47	NS	0.88	5	MS

Note: Most Significant at: *RII≥ 0.76; MS= Most significant, S= Significant, LS= Less significant.

The result in Table 4.9 shows that 17 factors were rated to have at least significant influence on the decision to insource maintenance service in tertiary institutions in South-West, Nigeria.

The most significant factors influencing the decision to insource maintenance services include; the development of internal staff (RII=0.93), the consideration of maintenance activities as core to tertiary institutions (RII=0.90), difficulty in appraising subcontractor's performance (RII=0.89) and difficulty in getting trustworthy contractors (RII=0.88) among others.

On the other hand, the results in Table 4.9 show that 35 factors were rated to have at least significant influence on the decision to outsource maintenance services in tertiary institutions in South-West, Nigeria. The most significant factors influencing the decision to outsource maintenance services in tertiary institutions include; the need for specialised expertise (RII=0.92), strategic alliance with contractors (RII=0.91) and the need for specialised management (RII=0.91).

Furthermore, the 17 and 35 factors that were found to have a significant and most significant influence on insourcing and outsourcing decisions were subjected to Principal Component Analysis (PCA) respectively. This was done to determine the key factors influencing each of the sourcing decisions based on their factor loadings and to have the factors categorised.

The following subsections show the report of the principal component analysis of the 17 and 35-factor variables influencing insourcing and outsourcing practices respectively.

4.5.1 Principal Component Analysis (PCA) of Insourcing Decision Factors

For the 17 variables influencing decision to adopt in-sourcing practice for the maintenance of buildings in tertiary institutions. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was .81. The KMO was above the recommended threshold value of .6 (Muca, Puka,

Bani, & Shahu, 2013), and Bartlett's test of sphericity was significant at χ^2 (136) = 1669.71, p=.00, p < .05 as shown in Table 4.10. The values show that the population correlation matrix is an identity matrix which implies that the data are suitable for principal component analysis.

Table 4.10: Kaiser-Meyer-Olkin (KMO) and Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.807
Bartlett's Test of Sphericity	Approx. Chi-Square	1669.714
	df	136
	Sig.	.000

The diagonals of the anti-image correlation matrix show that some of the variables had values less than 0.5. This suggests that not all the 17 variables would have significant item loading in the final factor analysis. In addition, the communalities values as shown in Table 4.11 indicate that four of the factors had communalities values below the 0.3 thresholds. This implies that these variables do not share common variance with the other variables.

Table 4.11: Communalities for factors influencing insourcing decision

Factors influencing insourcing decision	Extraction
Timing and coordination of maintenance activities	.282
Potential damage to reputation of institution	.276
Maintenance is core to institution	.683
Difficulty of getting subcontractors with compatible organisation culture	.311
Potential conflict of interest between subcontractor and institution	.462

Factors influencing insourcing decision	Extraction
Difficulty in getting trustworthy subcontractors	.514
Economies of scale	.359
Difficulty in contracting unpredictable activities	.291
Difficulty in appraising subcontractor's performance	.503
Accelerate re-engineering benefits	.399
Safety management	.558
Consolidation and decentralisation	.576
Initiate innovative ideas and techniques	.569
Improve the technology for competitive advantage	.492
Developing internal staff	.083
Complexity of function	.352
Function difficult to manage and control	.488

Note: Extraction Method: Principal Component Analysis.

Based on the results of Table 4.10 and Table 4.11, principal component analysis was conducted on all 17 items included as variables for analysis. The Principal Component Analysis (PCA) was employed because the primary purpose of the analysis was to identify and categorise key factors influencing insourcing decision amidst the numerous significant and most significant factors. The Eigen values showed that the first factor explained 23.3% of the variance, the second factor 10% of the variance, and a third factor 9% of the variance. Initially, five and four-factor solutions were examined, using both varimax and Promax rotations of the factor loading matrix. The three-factor solution, which explained 42% of the variance, was preferred because of its 'leveling off' of Eigen values on the scree plot after three factors, and the insufficient number of primary loadings and difficulty of interpreting

the fourth and subsequent factors. Both the varimax and promax solutions were examined but because of the assumption that the factors are related to one another, the promax rotation was adopted as the final solution.

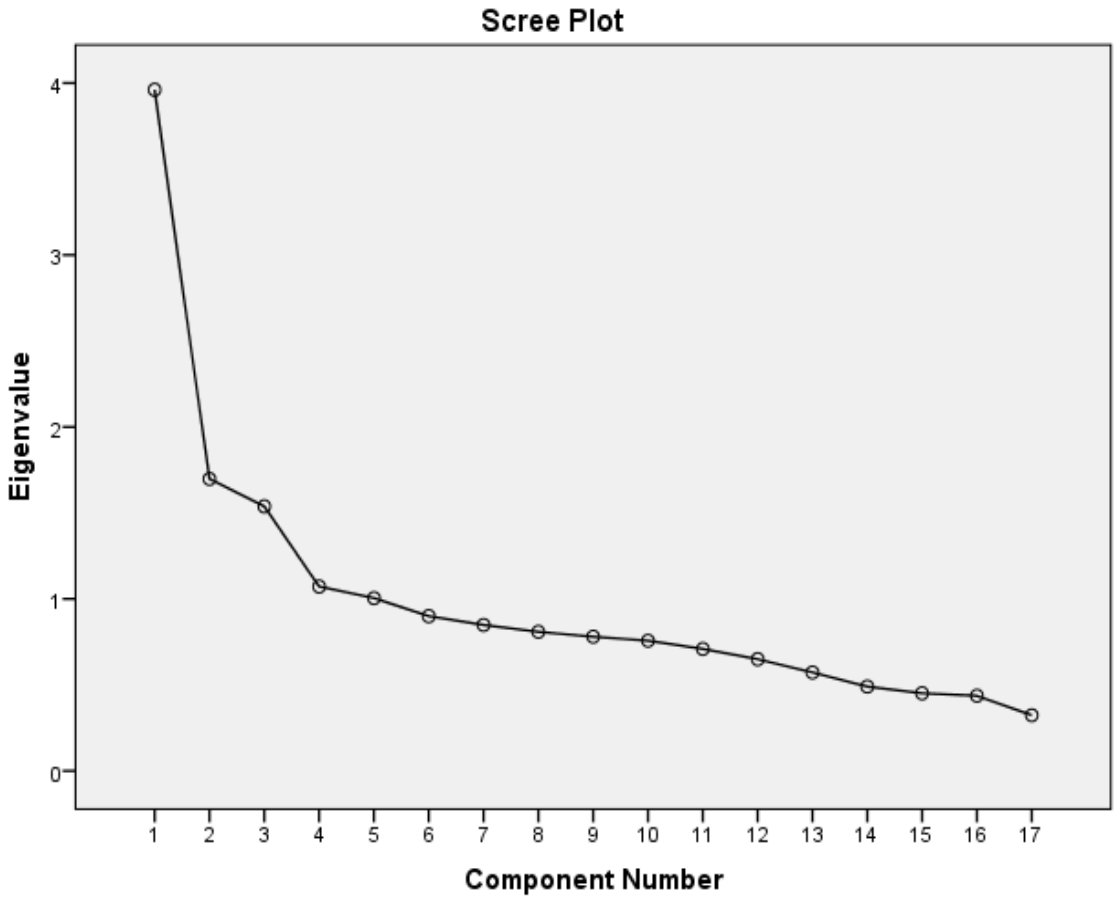

Figure 4.3: Scree plot of factors influencing insourcing decision

During several steps, none of the factors was eliminated because each of the factors contribute to the factor structure and met the minimum criteria of having a primary factor loading of 0.4 or above, and cross-loading of .3 or above. Table 4.12 shows the final result of the factor loading for each of the variables. The results of the rotated pattern matrix shows that the following factors were significantly loaded under the 3 components:

1. To initiate innovative ideas and techniques

2. Difficulty in appraising subcontractor's performance
3. Maintenance activities are core to institution

Table 4.12: Rotated Pattern Matrix for Insourcing Factors

Factors influencing insourcing decision	Component Matrices		
	1	**2**	**3**
To initiate innovative ideas and techniques	**.76**		
Consolidation and decentralisation	.75		
Safety management	.72		
Improved technology for competitive advantage	.71		
Function difficult to manage and control	.67		
Accelerate re-engineering benefits	.58		
Economies of scale	.47	.34	
Difficulty in contracting unpredictable activities	.46		
Potential damage to reputation of institution	.44		
Difficulty in appraising subcontractor's performance		**.67**	
Difficulty in getting trustworthy subcontractors		.64	.31
Difficulty of getting subcontractors with compatible organisation culture		.46	-.34
Timing and coordination of maintenance activities		.45	
Developing internal staff		.43	
Maintenance is core to institution		.31	**.67**
Complexity of function			.58

Factors influencing insourcing decision	Component Matrices		
	1	2	3
Potential conflict of interest between subcontractor and institution	.31		.57

Note: Extraction Method: Principal Component Analysis,
Rotation Method: Promax with Kaiser Normalization, Rotation converged in 6 iterations.

It is important to state that all the three factors were among the top rated factors as previously shown in Table 4.9. Therefore, it can be concluded that strategic, management and technological factors are the key factors that influence the decision of policy makers in tertiary institutions to adopt in-sourcing maintenance practice.

4.5.2 Principal Component Analysis (PCA) of Outsourcing Decision Factors

This category comprises 35 variables influencing decision to adopt outsourcing practice for the maintenance of buildings in tertiary institutions. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was 0.95. The KMO was above the recommended threshold value of .6 (Muca et al., 2013), and Bartlett's test of sphericity was significant at χ^2 (595) = 8975.99, p=.00, $p < .05$ as shown in Table 4.13. The values show that the population correlation matrix is an identity matrix which indicates the suitability of the data for factor analysis.

Table 4.13: Kaiser-Meyer-Olkin (KMO) and Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.951
Bartlett's Test of Sphericity	Approx. Chi-Square	8975.999

KMO and Bartlett's Test	
df	595
Sig.	.000

The diagonals of the anti-image correlation matrix show all the variables had values greater than 0.5. This suggests that not all the 35 variables would have significant item loading in the final factor analysis. In addition, all the communalities values are greater than 0.3 as shown in Table 4.14 indicating that variables share common variance with the one another variables. This implies that the criterion for factor analysis was met by the variables.

Table 4.14: Communalities for factors influencing outsourcing decision

Factors influencing outsourcing decision	Extraction
Focus on core activities	0.43
Access to world class capabilities	0.61
Freeing resources for core activities	0.71
Accelerate re-engineering benefits	0.51
Lack of internal resources for a service	0.42
Improve flexibility to the changing market dynamics	0.47
Strategic alliance with contractors	0.37
Save management time	0.50
Reduce management load	0.51
Need for specialised management	0.56
Increase the speed of implementation	0.59
Function difficult to manage	0.49

Factors influencing outsourcing decision	Extraction
Safety management	0.37
Consolidation and decentralisation	0.55
Achieve flexibility with changing technology	0.52
Initiate innovative ideas and techniques	0.58
Improve the technology for competitive advantage	0.44
Need for specialised expertise	0.51
Acquire new skills or technical knowledge	0.45
Save the overall cost	0.50
Reduce the labour and operating cost	0.55
Transform fixed cost into variable costs	0.55
Improve the cash flow	0.58
Cash infusion	0.55
Make capital funds more available for core activities	0.49
Increase the economic efficiency	0.51
Improve service quality	0.67
Improve quality requirements	0.67
Achieve high quality of service for competitive advantage	0.61
Procure higher reliability and competency	0.58
Complexity of function	0.53
Function integration and structure	0.48
Lack of spare parts	0.59
Function difficult to control	0.70
Lack in equipment /tools availability	0.58

Note: Extraction Method: Principal Component Analysis.

Based on the indicators of Table 4.13 and Table 4.14, factor analysis was conducted with all 35 items using the Principal Component Analysis (PCA) of factor analysis. The Eigen values showed that the first factor explained 41.1% of the variance, the second factor 4.6% of the variance, and the third factor 3% of the variance. Initially, five-factor solutions were was obtained using the Promax rotations of the factor loading matrix.

Table 4.14: Total Variance Explained by the Factor Components

Factor	Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings
	Total	% of Variance	Cumulative %	Total
1	14.390	41.114	41.114	11.919
2	1.595	4.558	45.672	10.925
3	1.209	3.455	49.126	10.700
4	.867	2.478	51.605	7.887
5	.687	1.962	53.566	9.566

Note: Extraction Method: Unweighted Least Squares.

However, the Eigen values of factors four and five were below one as shown in Table 4.14. Therefore three-factor solution was examined and the results show that 53% of the variance was equally explained by the factors. The three-factor solution was preferred because of its 'leveling off' of Eigen values on the scree plot after three factors, and the insufficient number of primary loadings and difficulty of interpreting the fourth and subsequent factors.

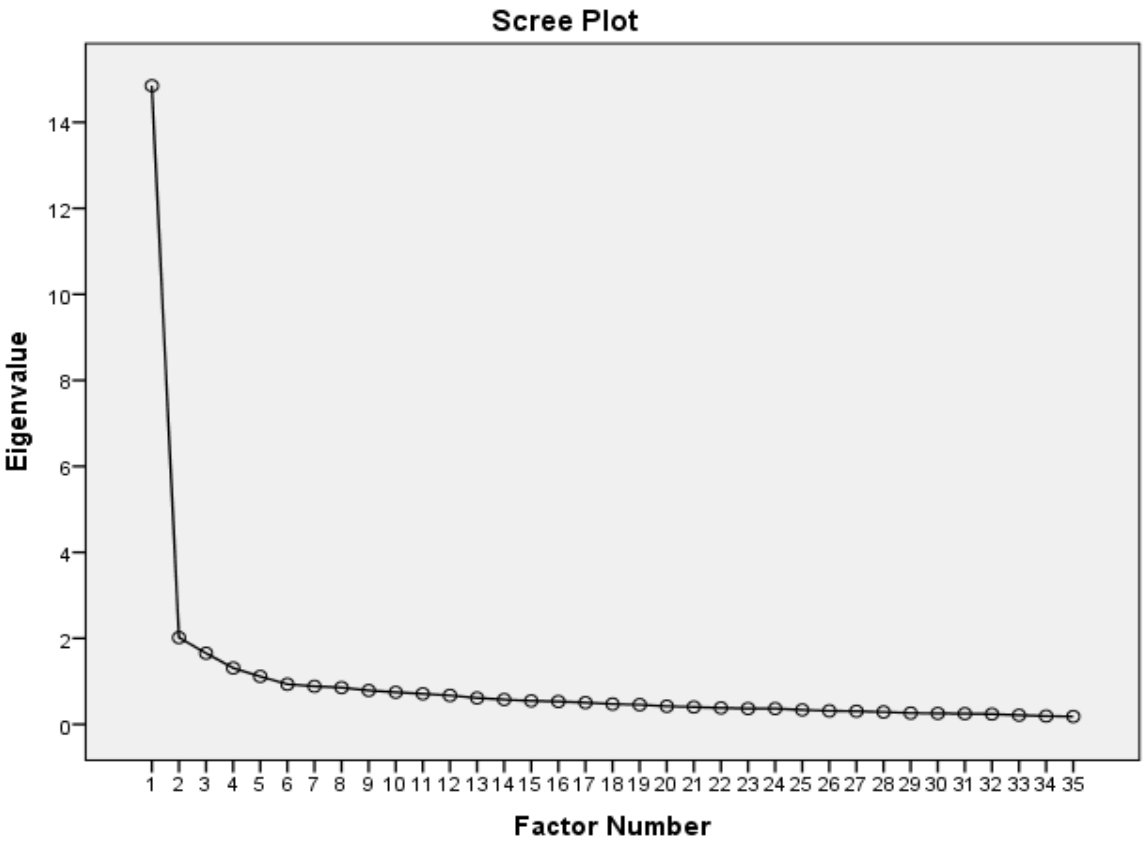

Figure 4.4: Scree plot of factors influencing outsourcing decision

During several steps, none of the factors were eliminated because each of the factors contributes to the factor structure and met the minimum criteria of having a primary factor loading of 0.4 or above and cross-loading of .3 or above. Table 4.15 shows the final result of the factor loading for each of the variables.

Table 4.15: Rotated Pattern Matrix for Outsourcing Factors

Factors influencing outsourcing decision	**Component Matrices**		
	1	**2**	**3**
Need for specialised expertise	**.769**		
Achieve flexibility with changing technology	.727		

Factors influencing outsourcing decision	Component Matrices		
	1	2	3
Increase the speed of implementation	.717		
Access to world class capabilities	.686		
Improve the technology for competitive advantage	.681		
Freeing resources for core activities	.674		
Save management time	.674		
Reduce management load	.661		
Need for specialised management	.618		
Accelerate re-engineering benefits	.615		
Consolidation and decentralisation	.610		
Initiate innovative ideas and techniques	.473	.346	
Function difficult to manage	.447		.399
Safety management	.433		
Focus on core activities	.409		
Improved service quality		**.848**	
Procure higher reliability and competency		.768	
Achieve high quality of service for competitive advantage		.755	
Improve quality requirements		.718	
Increase the economic efficiency		.686	
Complexity of function		.606	
Make capital funds more available for core activities		.594	

Factors influencing outsourcing decision	Component Matrices		
	1	2	3
Save the overall cost		.590	
Function integration and structure		.548	.339
Reduce the labour and operating cost		.475	.441
Acquire new skills or technical knowledge	.329	.457	
Function difficult to manage and control			**.823**
Lack of equipment /tools availability			.800
Lack of spare parts			.734
Lack of internal resources for a service			.582
Cash infusion			.542
Transform fixed cost into variable costs			.539
Strategic alliance with contractors	.319		.510
Improve flexibility to the changing market dynamics			.498
Improve the cash flow		.432	.470

Note: Extraction Method: Principal Component Analysis,
Rotation Method: Promax with Kaiser Normalization, Rotation converged in 8 iterations.

The results of the rotated pattern matrix shown in Table 4.15 indicate that the following factors were significantly loaded under the 3 components:

1. Need for specialised expertise
2. Improved service quality
3. Difficulty in managing and controlling maintenance function.

All the three factors were among the top rated factors influencing outsourcing decision as previously shown in Table 4.9. Therefore, it can be concluded that strategic, quality and

management factors are the dominant factors that influence the decision of policy makers in tertiary institutions to adopt outsourcing maintenance practice.

4.5.1 Test of Hypothesis 2

Null Hypothesis (H_0): There is no significant difference in the factors influencing decisions to insource or outsource building maintenance services between the categories of tertiary institutions in South-West, Nigeria.

Alternative Hypothesis (H_1): There is significant difference in the factors influencing decisions to insource or outsource building maintenance between the categories of tertiary institutions in South-West, Nigeria.

Hypothesis two was subdivided into four. The subdivision was along the consideration of the institutional characteristics of Universities and Polytechnics, and maintenance sourcing practices of insourcing and outsourcing respectively. The following paragraphs show the results of each of the four sub-hypotheses.

4.5.1.1 Test of Sub-hypothesis 2a

Null Hypothesis (H_0): There is no significant difference in the factors influencing decision to insource maintenance services between Federal, State and Private Universities in South-West, Nigeria.

Alternative Hypothesis (H_1): There is significant difference in the factors influencing the decision to insource maintenance services between Federal, State and Private Universities in South-West, Nigeria.

The postulated hypothesis was tested using Welch's Analysis of Variance Test. The Welch's ANOVA was adopted in order to accommodate for the unequal variances and unequal sample sizes across the institutions (Cooper and Schindler, 2014). The results of the analysis are presented in Table 4.16.

Table 4.16: Welch's ANOVA of factors influencing the decision to insource maintenance services in Federal, State, and Private Universities Nigeria.

Sourcing decision factors	Test	F	df1	df2	*p*-value	Remark
Timing and coordination of maintenance activities	Welch's test	1.63	2.00	203.20	0.20	NS
Potential damage to reputation of institution	Welch's test	4.33	2.00	201.98	0.01	S
Maintenance is core to institution	Welch's test	4.28	2.00	205.55	0.02	S
Difficulty of getting subcontractors with compatible organisation culture	Welch's test	0.38	2.00	210.43	0.68	NS
Potential conflict of interest between subcontractor and institution	Welch's test	0.35	2.00	208.42	0.70	NS
Difficulty in getting trustworthy subcontractors	Welch's test	0.77	2.00	206.78	0.46	NS
Economies of scale	Welch's test	1.30	2.00	219.48	0.27	NS
Difficulty in contracting unpredictable activities	Welch's test	1.63	2.00	217.93	0.20	NS

Sourcing decision factors	Test	F	df1	df2	*p*-value	Remark
Difficulty in appraising subcontractor's performance	Welch's test	2.76	2.00	228.64	0.07	NS
Potential loss of investments	Welch's test	3.76	2.00	200.93	0.03	S
Focus on core activities	Welch's test	3.17	2.00	203.87	0.04	S
Access to world class capabilities	Welch's test	6.07	2.00	196.06	0.00	S
Freeing resources for core activities	Welch's test	0.34	2.00	209.47	0.71	NS
Accelerate re-engineering benefits	Welch's test	2.87	2.00	199.76	0.06	NS
Risk sharing with contractors	Welch's test	2.78	2.00	224.67	0.06	NS
Lack of internal resources for a service	Welch's test	4.34	2.00	218.03	0.01	S
Improve flexibility to the changing market dynamics	Welch's test	4.49	2.00	213.73	0.01	S
Strategic alliance with contractors	Welch's test	10.56	2.00	195.61	0.00	S
Regulations governing outsourcing practices	Welch's test	5.98	2.00	193.19	0.00	S
Save management time	Welch's test	2.15	2.00	195.30	0.12	NS
Reduce management load	Welch's test	7.90	2.00	201.57	0.00	S
Need for specialised management	Welch's test	13.77	2.00	194.59	0.00	S

Sourcing decision factors	Test	F	df1	df2	*p*-value	Remark
Increase the speed of implementation	Welch's test	0.48	2.00	203.05	0.62	NS
Function difficult to manage and control	Welch's test	1.88	2.00	199.67	0.16	NS
Safety management	Welch's test	3.87	2.00	198.10	0.02	S
Consolidation and decentralisation	Welch's test	0.61	2.00	206.19	0.54	NS
Achieve flexibility with changing technology	Welch's test	12.22	2.00	217.70	0.00	S
Initiate innovative ideas and techniques	Welch's test	0.45	2.00	212.74	0.64	NS
Improve the technology for competitive advantage	Welch's test	2.50	2.00	200.35	0.08	NS
Technology requirements uncertainty	Welch's test	1.88	2.00	206.81	0.16	NS
Need for specialised expertise	Welch's test	0.50	2.00	220.95	0.61	NS
Acquire new skills or technical knowledge	Welch's test	2.64	2.00	202.67	0.07	NS
Overall maintenance cost reduction	Welch's test	1.80	2.00	213.86	0.17	NS
Developing internal staff	Welch's test	5.40	2.00	211.95	0.01	S
Transform fixed cost into variable costs	Welch's test	4.44	2.00	210.45	0.01	S
Improve the cash flow	Welch's test	1.22	2.00	208.43	0.30	NS

Sourcing decision factors	Test	F	df1	df2	*p*-value	Remark
Cash infusion	Welch's test	1.52	2.00	211.26	0.22	NS
Make capital funds more available for core activities	Welch's test	5.00	2.00	203.84	0.01	S
Increase the economic efficiency	Welch's test	5.01	2.00	201.28	0.01	S
Improve service quality	Welch's test	1.51	2.00	212.43	0.22	NS
Improve quality requirements	Welch's test	4.35	2.00	202.19	0.01	S
Achieve high quality of service for competitive advantage	Welch's test	3.22	2.00	208.12	0.04	S
Procure higher reliability and competency	Welch's test	4.32	2.00	208.16	0.01	S
Complexity of function	Welch's test	1.61	2.00	209.54	0.20	NS
Function integration and structure	Welch's test	1.90	2.00	212.71	0.15	NS
Lack of spare parts	Welch's test	8.73	2.00	215.42	0.00	S
Lack in equipment /tools availability	Welch's test	2.07	2.00	199.48	0.13	NS
Improve process responsiveness and cycle time	Welch's test	5.08	2.00	202.63	0.01	S
Accountability	Welch's test	1.79	2.00	201.71	0.17	NS
Overall		**3.50**	**2.00**	**207**	**0.17**	**NS**

Note: Significant at *p≤0.05

The result in Table 4.16 shows that on the overall, F (2, 207) = 3.50, p= 0.17. Hence, with p>.05, the null hypothesis was accepted. This implies that there is no significant difference in the factors influencing the decision to insource maintenance services between Federal, State and Private Universities in South-West, Nigeria.

4.5.1.2 Test of Sub-hypothesis 2b

Null Hypothesis (H_0): There is no significant difference in the factors influencing the decision to outsource maintenance services between Federal, State and Private Universities in South-West, Nigeria.

Alternative Hypothesis (H_1): There is significant difference in the factors influencing the decision to outsource maintenance services between Federal, State and Private Universities in South-West, Nigeria.

The postulated hypothesis was tested using Welch's Analysis of Variance Test. The hypothesis seeks to establish if there was a significant difference between Federal, State and Private Universities on the factors that influence the decision to carry out maintenance services using outsourcing practice. The results of the analysis are presented in Table 4.17.

Table 4.17: Welch's ANOVA of factors influencing the decision to outsource maintenance services in Federal, State, and Private Universities Nigeria.

Sourcing decision factors	Test	F	df1	df2	*p*-value	Remark
Timing and coordination of maintenance activities	Welch's test	1.07	2.00	192.85	0.35	NS

Sourcing decision factors	Test	F	df1	df2	*p*-value	Remark
Potential damage to reputation of institution	Welch's test	0.62	2.00	201.03	0.54	NS
Maintenance is core to institution	Welch's test	0.51	2.00	194.66	0.60	NS
Difficulty of getting subcontractors with compatible organisation culture	Welch's test	1.09	2.00	201.57	0.34	NS
Potential conflict of interest between subcontractor and institution	Welch's test	1.20	2.00	202.59	0.30	NS
Difficulty in getting trustworthy subcontractors	***					
Economies of scale	Welch's test	2.41	2.00	208.54	0.09	NS
Difficulty in contracting unpredictable activities	Welch's test	3.34	2.00	207.33	0.04	S
Difficulty in appraising subcontractor's performance	Welch's test	2.25	2.00	201.71	0.11	NS
Potential loss of investments	Welch's test	2.43	2.00	198.46	0.09	NS
Focus on core activities	Welch's test	0.41	2.00	208.60	0.66	NS
Access to world class capabilities	Welch's test	4.50	2.00	196.68	0.01	S
Freeing resources for core activities	Welch's test	3.48	2.00	195.70	0.03	S

Sourcing decision factors	Test	F	df1	df2	*p*-value	Remark
Accelerate re-engineering benefits	Welch's test	2.99	2.00	201.06	0.05	S
Risk sharing with contractors	Welch's test	2.14	2.00	196.94	0.12	NS
Lack of internal resources for a service	Welch's test	0.03	2.00	215.16	0.97	NS
Improve flexibility to the changing market dynamics	Welch's test	1.95	2.00	198.27	0.15	NS
Strategic alliance with contractors	Welch's test	1.39	2.00	200.24	0.25	NS
Regulations governing outsourcing practices	Welch's test	4.09	2.00	190.21	0.02	S
Save management time	Welch's test	2.39	2.00	195.62	0.09	NS
Reduce management load	Welch's test	1.70	2.00	207.23	0.18	NS
Need for specialised management	Welch's test	0.73	2.00	208.69	0.48	NS
Increase the speed of implementation	Welch's test	2.58	2.00	194.86	0.08	NS
Function difficult to manage and control	Welch's test	0.30	2.00	198.68	0.74	NS
Safety management	Welch's test	5.25	2.00	191.14	0.01	S
Consolidation and decentralisation	Welch's test	1.00	2.00	201.18	0.37	NS
Achieve flexibility with changing technology	Welch's test	2.00	2.00	201.11	0.14	NS

Sourcing decision factors	Test	F	df1	df2	*p*-value	Remark
Initiate innovative ideas and techniques	Welch's test	1.12	2.00	210.27	0.33	NS
Improve the technology for competitive advantage	Welch's test	2.96	2.00	199.45	0.05	S
Technology requirements uncertainty	Welch's test	2.02	2.00	200.24	0.14	NS
Need for specialised expertise	Welch's test	3.07	2.00	194.61	0.05	S
Acquire new skills or technical knowledge	Welch's test	0.46	2.00	190.51	0.63	NS
Overall maintenance cost reduction	Welch's test	0.49	2.00	198.71	0.61	NS
Developing internal staff	Welch's test	0.42	2.00	203.55	0.66	NS
Transform fixed cost into variable costs	Welch's test	2.32	2.00	201.65	0.10	NS
Improve the cash flow	Welch's test	2.71	2.00	203.25	0.07	NS
Cash infusion	Welch's test	6.30	2.00	195.51	0.00	S
Make capital funds more available for core activities	Welch's test	3.82	2.00	197.61	0.02	S
Increase the economic efficiency	Welch's test	2.71	2.00	198.97	0.07	NS
Improve service quality	Welch's test	0.62	2.00	199.24	0.54	NS
Improve quality requirements	Welch's test	0.63	2.00	194.91	0.53	NS

Sourcing decision factors	Test	F	df1	df2	*p*-value	Remark
Achieve high quality of service for competitive advantage	Welch's test	1.34	2.00	204.70	0.27	NS
Procure higher reliability and competency	Welch's test	1.53	2.00	206.56	0.22	NS
Complexity of function	Welch's test	4.49	2.00	202.40	0.01	S
Function integration and structure	Welch's test	2.03	2.00	199.89	0.13	NS
Lack of spare parts	Welch's test	0.66	2.00	216.20	0.52	NS
Lack in equipment /tools availability	Welch's test	1.06	2.00	213.18	0.35	NS
Improve process responsiveness and cycle time	Welch's test	0.66	2.00	216.20	0.52	NS
Accountability	Welch's test	0.70	2.00	203.76	0.50	NS
Overall		**2.08**	**2.00**	**201.60**	**0.26**	**NS**

Note: Significant at *p≤0.05, ***= Robust tests of equality of means could not be performed because at least one group has 0 variances.

Table 4.17 shows the result of Welch's Analysis of Variance for the difference in factors influencing the decision to outsource maintenance services between Federal, State and Private Universities in South-West, Nigeria. The overall result in Table 4.17 reveals that F (2, 202) =2.08, *p*=0.26. With p>.05, the null hypothesis was accepted. This implies that there is no significant difference in the factors influencing the decision to outsource maintenance services between Federal, State and Private Universities in South-West, Nigeria.

4.5.1.3 Test of Sub-hypothesis 2c

Null Hypothesis (H_0): There is no significant difference in the factors influencing the decision to insource maintenance services between Federal, State and Private Polytechnics in South-West, Nigeria.

Alternative Hypothesis (H_1): There is significant difference in the factors influencing the decision to insource maintenance services between Federal, State and Private Polytechnics in South-West, Nigeria.

The postulated hypothesis was tested using the Welch's Analysis of Variance Test. The hypothesis seeks to establish if there was a significant difference in the factors that influences the decision to carry out maintenance services between Federal, State and Private polytechnics using insourcing maintenance practice. The results of the analysis is presented in Table 4.18.

Table 4.18: Welch's ANOVA of factors influencing the decision to insource maintenance services in Federal, State, and Private Polytechnics.

Sourcing decision factors	Test	F	df1	df2	*p*-value	Remark
Timing and coordination of maintenance activities	Welch's test	.05	2.00	23.21	.95	NS
Potential damage to reputation of institution	Welch's test	.84	2.00	20.56	.44	NS
Maintenance is core to institution	Welch's test	.66	2.00	19.74	.53	NS

Sourcing decision factors	Test	F	df1	df2	*p*-value	Remark
Difficulty of getting subcontractors with compatible organisation culture	Welch's test	.38	2.00	20.93	.69	NS
Potential conflict of interest between subcontractor and institution	Welch's test	1.42	2.00	20.33	.27	NS
Difficulty in getting trustworthy subcontractors	Welch's test	8.83	2.00	24.52	.00	S
Economies of scale	Welch's test	.68	2.00	20.50	.52	NS
Difficulty in contracting unpredictable activities	Welch's test	.75	2.00	21.92	.49	NS
Difficulty in appraising subcontractor's performance	Welch's test	7.54	2.00	21.17	.00	S
Potential loss of investments	Welch's test	.05	2.00	21.73	.96	NS
Focus on core activities	Welch's test	.19	2.00	20.93	.83	NS
Access to world class capabilities	Welch's test	.46	2.00	20.92	.64	NS
Freeing resources for core activities	Welch's test	.28	2.00	19.96	.76	NS
Accelerate re-engineering benefits	Welch's test	2.68	2.00	21.46	.09	NS
Risk sharing with contractors	***					
Lack of internal resources for a service	***					

Sourcing decision factors	Test	F	df1	df2	*p*-value	Remark
Improve flexibility to the changing market dynamics	***					
Strategic alliance with contractors	***					
Regulations governing outsourcing practices	Welch's test	1.86	2.00	23.66	.18	NS
Save management time	Welch's test	1.27	2.00	25.13	.30	NS
Reduce management load	Welch's test	.56	2.00	24.86	.58	NS
Need for specialised management	Welch's test					
Increase the speed of implementation	Welch's test	1.22	2.00	21.19	.32	NS
Function difficult to manage and control	Welch's test	.09	2.00	21.20	.91	NS
Safety management	Welch's test	.15	2.00	20.41	.86	NS
Consolidation and decentralisation	Welch's test	.45	2.00	20.48	.64	NS
Achieve flexibility with changing technology	Welch's test					
Initiate innovative ideas and techniques	Welch's test	.25	2.00	21.20	.78	NS
Improve the technology for competitive advantage	Welch's test	.61	2.00	22.59	.55	NS

Sourcing decision factors	Test	F	df1	df2	*p*-value	Remark
Technology requirements uncertainty	Welch's test	1.29	2.00	20.78	.30	NS
Need for specialised expertise	Welch's test					NS
Acquire new skills or technical knowledge	Welch's test	.47	2.00	25.44	.63	NS
Overall maintenance cost reduction	Welch's test	1.94	2.00	22.68	.17	NS
Developing internal staff	Welch's test	.00	2.00	21.22	1.00	NS
Transform fixed cost into variable costs	Welch's test	1.64	2.00	25.40	.21	NS
Improve the cash flow	Welch's test	.97	2.00	22.57	.40	NS
Cash infusion	***					
Make capital funds more available for core activities	***					
Increase the economic efficiency	Welch's test	.45	2.00	24.69	.64	NS
Improve service quality	Welch's test	3.66	2.00	24.17	.04	
Improve quality requirements	Welch's test	.27	2.00	21.94	.77	NS
Achieve high quality of service for competitive advantage	***					
Procure higher reliability and competency	Welch's test	2.92	2.00	22.93	.07	NS
Complexity of function	Welch's test	1.87	2.00	19.91	.18	NS
Function integration and structure	Welch's test	1.19	2.00	25.59	.32	NS

Sourcing decision factors	Test	F	df1	df2	*p*-value	Remark
Lack of spare parts	Welch's test	.88	2.00	20.82	.43	NS
Lack in equipment /tools availability	Welch's test	.35	2.00	21.37	.71	NS
Improve process responsiveness and cycle time	Welch's test	1.20	2.00	24.95	.32	NS
Accountability	Welch's test	1.00	2.00	18.62	.39	NS
Overall		**1.34**	**2.00**	**22.03**	**.35**	**NS**

Note: Significant at *p≤0.05, ***= Robust tests of equality of means could not be performed because at least one group has 0 variances.

The overall result in Table 4.18 shows that F (2, 22) =1.34, *p*=0.35. With p>.05, the null hypothesis was accepted. This implies that there is no significant difference in the factors influencing the decision to insource maintenance services between Federal, State and Private Polytechnics in South-West, Nigeria.

4.5.1.4 Test of Sub-hypothesis 2d

Null Hypothesis (H_0): There is no significant difference in the factors influencing the decision to outsource maintenance services between Federal, State and Private Polytechnics in South-West Nigeria.

Alternative Hypothesis (H_1): There is significant difference in the factors influencing the decision to outsource maintenance services between Federal, State and Private Polytechnics in South-West, Nigeria.

The postulated hypothesis was tested using Welch's Analysis of Variance test. The hypothesis seeks to establish if there was a significant difference in the factors that influences the decision to carry out maintenance services between Federal, State and Private polytecnics using outsourcing maintenance practice. The results of the analysis is presented in Table 4.19.

Table 4.19: Welch's ANOVA of factors influencing the decision to outsource maintenance services in Federal, State and Private Polytechnics in South-West, Nigeria.

Sourcing decision factors	Test	F	df1	df2	*p*-value	Remark
Timing and coordination of maintenance activities	Welch's test	.78	2.00	21.71	.47	NS
Potential damage to reputation of institution	Welch's test	2.69	2.00	21.51	.09	NS
Maintenance is core to institution	Welch's test	.46	2.00	20.81	.64	NS
Difficulty of getting subcontractors with compatible organisation culture	Welch's test	7.11	2.00	24.76	.00	S
Potential conflict of interest between subcontractor and institution	Welch's test	3.14	2.00	21.22	.06	NS
Difficulty in getting trustworthy subcontractors	***					
Economies of scale	Welch's test	.99	2.00	21.70	.39	NS

Sourcing decision factors	Test	F	df1	df2	*p*-value	Remark
Difficulty in contracting unpredictable activities	Welch's test	3.39	2.00	21.79	.05	S
Difficulty in appraising subcontractor's performance	Welch's test	3.76	2.00	21.94	.04	S
Potential loss of investments	Welch's test	2.84	2.00	21.60	.08	NS
Focus on core activities	Welch's test	2.80	2.00	20.49	.08	NS
Access to world class capabilities	Welch's test	.92	2.00	20.47	.41	NS
Freeing resources for core activities	Welch's test	.36	2.00	20.65	.70	NS
Accelerate re-engineering benefits	Welch's test	2.62	2.00	21.37	.10	NS
Risk sharing with contractors	Welch's test	.91	2.00	21.49	.42	NS
Lack of internal resources for a service	Welch's test	.29	2.00	15.89	.75	NS
Improve flexibility to the changing market dynamics	Welch's test	.68	2.00	21.46	.52	NS
Strategic alliance with contractors	Welch's test	.94	2.00	20.82	.41	NS
Regulations governing outsourcing practices	Welch's test	.31	2.00	20.84	.74	NS
Save management time	Welch's test	2.14	2.00	20.43	.14	NS
Reduce management load	Welch's test	1.30	2.00	20.68	.29	NS

Sourcing decision factors	Test	F	df1	df2	*p*-value	Remark
Need for specialised management	Welch's test	1.18	2.00	21.35	.33	NS
Increase the speed of implementation	Welch's test	3.14	2.00	22.00	.06	NS
Function difficult to manage and control	Welch's test	.50	2.00	21.25	.61	NS
Safety management	Welch's test	.28	2.00	20.73	.76	NS
Consolidation and decentralisation	Welch's test	.54	2.00	20.14	.59	NS
Achieve flexibility with changing technology	Welch's test	.63	2.00	20.97	.54	NS
Initiate innovative ideas and techniques	Welch's test	.35	2.00	21.21	.71	NS
Improve the technology for competitive advantage	Welch's test	.77	2.00	22.79	.48	NS
Technology requirements uncertainty	Welch's test	.67	2.00	20.18	.52	NS
Need for specialised expertise	Welch's test	1.68	2.00	22.80	.21	NS
Acquire new skills or technical knowledge	Welch's test	6.33	2.00	21.19	.01	S
Overall maintenance cost reduction	Welch's test	1.01	2.00	20.49	.38	NS
Developing internal staff	Welch's test	.01	2.00	20.84	.99	NS

Sourcing decision factors	Test	F	df1	df2	*p*-value	Remark
Transform fixed cost into variable costs	Welch's test	.21	2.00	20.41	.82	NS
Improve the cash flow	Welch's test	2.54	2.00	25.55	.10	NS
Cash infusion	Welch's test	2.00	2.00	26.29	.15	NS
Make capital funds more available for core activities	Welch's test	.97	2.00	20.68	.40	NS
Increase the economic efficiency	Welch's test	4.70	2.00	22.79	.02	NS
Improve service quality	Welch's test	.35	2.00	27.14	.71	NS
Improve quality requirements	Welch's test	3.31	2.00	25.48	.05	NS
Achieve high quality of service for competitive advantage	Welch's test	1.04	2.00	20.77	.37	NS
Procure higher reliability and competency	Welch's test	2.33	2.00	24.97	.12	NS
Complexity of function	Welch's test	3.21	2.00	21.41	.06	NS
Function integration and structure	Welch's test	1.02	2.00	21.70	.38	NS
Lack of spare parts	Welch's test	1.41	2.00	21.98	.27	NS
Lack in equipment /tools availability	Welch's test	.22	2.00	22.22	.81	NS
Improve process responsiveness and cycle time	Welch's test	1.41	2.00	21.98	.27	NS
Accountability	Welch's test	4.74	2.00	23.14	.02	S

Sourcing decision factors	Test	F	df1	df2	*p*-value	Remark
Overall		**1.65**	**2.00**	**21.72**	**.37**	**NS**

Note: Significant at *p≤0.05, ***= Robust tests of equality of means could not be performed because at least one group has 0 variances.

The overall Welch's ANOVA result in table 4.19 shows that F (2, 22) =1.65, p=0.37. With *p*>.05, the null hypothesis was accepted. This implies that there is no significant difference in the factors influencing the decision to outsource maintenance services between Federal, State and Private Polytechnics in South-West, Nigeria.

This result aligns with the results of Dawne (2011) that maintenance services are insourced in institutions and organisations because policy makers consider maintenance too as a core activity that impacts institution's or organisation's productivity. The author explains that prompt delivery of maintenance services is usually required to minimise operation down time and enhance organisation's productivity. In addition APSE (2011) explains that it is better for institutions to insource services that are considered critical to the institution's daily operations. Lateef, Khamidi, and Idrus (2011) explain that maintenance activities are crucial to the preservation of buildings in tertiary institutions. The authors argue that buildings in tertiary institutions require consistent maintenance attention. Such maintenance attention would create a suitable, and adequate environment that support, stimulate and encourage learning, teaching and innovation, and research activities.

Furthermore, the result of this study supports that of Sheng (2012) and Muchai and Acosta, (2012) that institutions often times engage the services of third party vendors to execute maintenance activities requiring high-level specialty. In addition, the result that the factors influencing decision to insource or outsource maintenance services do not differ across the institutions.aligns with the findings of Steenbeek, Wijngaert, Brand and Harmsen (2005). The

authors opine that similar factors are likely to influence the decision of firms or organisation with similar business goals.

Sriwongwanna (2009) reiterates that services for which in-house maintenance staff lacks adequate knowledge to deliver should be outsourced. The result also supports the position of APSE (2011) that improved service quality is a critical factor when considering services for outsourcing. The result is in contrast with the results of Assaf, Hassanain, Al-Hammad, and Al-Nehmi (2011) that increased the speed of service implementation is the most significant factor influencing decision to outsource maintenance services.

4.6 Quality of Insourced and Outsourced Building Maintenance Services in Tertiary Institutions

To further meet the objectives of this study, this study investigates the gaps in the quality of building maintenance services rendered using insourcing and outsourcing maintenance practices in tertiary institutions in South-West, Nigeria. In doing this, the service quality gap model proposed by Parasuraman (1988) was adopted. The service quality gap model has been demonstrated in the literature (Toossi, 2011; Manani *et al*., 2013) to be an effective method for assessing the gap between expectation and perception of quality of service by those receiving the service (i.e. service customers).

In the context of this study, the expectations and perceptions of users of buildings in the various tertiary institutions across the South-West region were measured using a 7-point scale to rate their expectations and perceptions respectively. Higher number rating indicate a higher level of expectation or perception as the case may be. The building users' perception was based on their experience of the actual quality of maintenance services that they have received

over time. Their expectations were based on the minimum quality of services that the maintenance staff should be delivered from the building users' point of view.

The service quality gap scores were measured as the difference between the perception rating and the expectation rating (P-E). The gap score has a possible range of values from -6 to +6 (where -6 indicate a very dissatisfied situation and +6 indicate very satisfied situation). The more positive the P-E scores, the higher the level of service quality leading to a higher level of customer satisfaction. Satisfaction and service quality were both treated as functions of users' perceptions and expectations. Table 4.20 shows the results for the quality insourced and outsourced maintenance services.

Table 4.20: Quality of insourced and outsourced maintenance services

Service Quality Dimensions		Insourced maintenance				Outsourced maintenance			
	W	**E**	**P**	**G**	**WGS**	**E**	**P**	**G**	**WGS**
Tangibility (maintenance staff; has good and up-to-date equipment, are well dressed and appears neat, use quality materials and keep accurate records)	19.18	5.64	4.68	-0.96	-18.41	5.90	6.25	0.35	6.71
Reliability (The maintenance staff ability to perform the maintenance service dependably and accurately)	21.33	5.75	4.50	-1.25	-26.57	5.53	4.82	-0.71	-15.14
Responsiveness (maintenance staff; are always willing to help building users and provide a prompt service)	21.97	5.73	3.73	-2.00	-43.91	5.78	6.04	0.26	5.71
Assurance (maintenance staff; has knowledge of task and are courteous, possess ability to convey trust and confidence)	19.75	5.60	5.75	0.15	2.87	5.45	5.56	0.11	2.10
Empathy (maintenance staff; provide individualized attention and operating hours are convenient to building users)	17.77	5.68	3.62	-2.06	-36.66	5.89	5.72	-0.17	-3.02
Overall	**100**	**5.68**	**4.46**	**-1.22**	**-24.54**	**5.71**	**5.68**	**-0.03**	**-0.73**

*Note: W=dimension weight, E=expected quality of service, P=perceived quality of service, G=gap in service (P-E), WGS=weighted service gap score.

From the results in Table 4.20, the dimension weight reflect the level of importance given to each of the quality of service dimensions by the building users. The result shows that the most important attribute of good maintenance service to the respondents is the promptness at which maintenance staff attends to maintenance request (W=21.97). This is closely followed by the ability of maintenance staff to carry out the requested maintenance service accurately (W=21.33). This study adopts the threshold score of 5.6 out of 7 (80% of the maximum) as the minimum perception score needed to measure true satisfaction for each of the service dimensions (Gibson, 2009).

Furthermore, the result shows that the quality of outsourced maintenance services was better (P=5.68) than the quality of maintenance services performed using in-sourcing practice (P=4.46) on the overall. In addition, the results revealed that for insourced maintenance services, the respondents were satisfied with only the assurance dimension (i.e. the level of knowledge demonstrated by the in-house maintenance staff in resolving maintenance issues). Whereas, the results show that the respondents were satisfied with three (3) of the five (5) quality of service dimensions comprising; tangibility, responsiveness, and empathy of outsourced maintenance staff. This implies that outsourced maintenance staff had better and modern equipment, use materials of better quality, were more prompt at providing maintenance services and provide more individualised attention among others, than their insourced counterparts.

4.6.1 Test of Hypothesis 3

Null Hypothesis (H_0): There is no significant difference between the expected and perceived quality of building maintenance services with respect to maintenance sourcing practices in tertiary institutions.

Alternative Hypothesis (H_1): There is significant difference between the expected and perceived quality of building maintenance services with respect to maintenance sourcing practices in tertiary institutions.

Hypothesis three was subdivided into two. The subdivision was along the consideration of the maintenance sourcing practices of insourcing and outsourcing respectively. The following paragraphs show the analysis and results for each of the two sub-hypotheses.

4.6.1.1 Test of Sub-hypothesis 3a

Null Hypothesis (H_0): There is no significant difference between the expected and perceived quality of insourced building maintenance services in tertiary institutions.

Alternative Hypothesis (H_1): There is significant difference between the expected and perceived quality of insourced building maintenance services in tertiary institutions.

The postulated hypothesis was tested using the paired samples test. The hypothesis seeks to establish if there was a significant difference between the expected and perceived quality of insourced maintenance services in tertiary institutions in South-West, Nigeria. Table 4.21 shows the result of the analysis.

Table 4.21: Paired samples t test of difference in the expected and perceived quality of insourced maintenance services in tertiary institutions in South-West, Nigeria.

Service Quality Measures (E Vs P)		MD	t	df	*p*-value	Remark
Pair 1	Modern equipment	1.397	13.979	364	.000	S

Service Quality Measures (E Vs P)		MD	t	df	*p*-value	Remark
Pair 2	Good physical facilities.	1.235	11.178	356	.000	S
Pair 3	Professional appearance of maintenance staff	.900	8.372	349	.000	S
Pair 4	Visually appealing and quality materials	.510	5.020	366	.000	S
Pair 5	Act according to promises	1.399	12.523	362	.000	S
Pair 6	Sincere interest in solving problems	1.140	10.568	363	.000	S
Pair 7	Services are performed right the first time.	1.116	9.759	361	.000	S
Pair 8	Provide services at the time promised	1.410	12.426	360	.000	S
Pair 9	Keeps error free records	1.203	11.466	359	.000	S
Pair 10	Informs building users exactly when maintenance services will be provided	-.290	-2.399	361	.017	S
Pair 11	Provides prompt services	-.378	-2.903	364	.004	S
Pair 12	Always willing to help	-.697	-4.061	359	.000	S
Pair 13	Never too busy to respond to service requests	-.458	-3.727	364	.000	S
Pair 14	Maintenance staff behaviour instils confidence	.806	7.435	354	.000	S
Pair 15	Building users feel secure in their transactions	.986	9.947	358	.000	S

Service Quality Measures (E Vs P)		MD	t	df	*p*-value	Remark
Pair 16	Maintenance staff are consistently courteous	.975	9.305	356	.000	S
Pair 17	Maintenance staff have the knowledge to answer questions	.914	9.579	359	.000	S
Pair 18	Provides individual attention	.056	.444	354	.657	NS
Pair 19	Has convenient operating hours	-.142	-1.167	359	.244	NS
Pair 20	Maintenance staff provide personal attention	-.127	-.972	361	.332	NS
Pair 21	Has the best interest of the building users at heart	-.025	-.210	360	.834	NS
Pair 22	Maintenance staff understand the needs of building users	-.268	-2.082	357	.038	S

Note: Significant at *p≤0.05, S = Significant, NS= Not significant; E=Expected quality of service, P=Perceived quality of service.

Table 4.21 shows that on the overall, the null hypothesis was rejected for (18 out of the 22) insourced quality of service measures. The result indicates that significant difference exists between the expectation and the perception of tertiary institution building users on the quality of insourced maintenance services. The implication of this result is that it further emphasise that the respondents were dissatisfied with the quality of maintenance services delivered by in-house maintenance staff across the tertiary institutions.

4.6.1.2 Test of Sub-hypothesis 3b

Null Hypothesis (H_0): There no significant difference between the expected and perceived quality of outsourced maintenance services in tertiary institutions.

Alternative Hypothesis (H_1): There is significant difference between the expected and perceived quality of outsourced maintenance services in tertiary institutions.

The postulated hypothesis was tested using the paired samples test. The hypothesis seeks to establish if there was a significant difference between the expected and perceived quality of outsourced maintenance services in tertiary institutions in South-West, Nigeria. Table 4.22 shows the result of the analysis.

Table 4.22: Paired samples t test of difference in the expected and perceived quality of outsourced maintenance services in tertiary institutions in South-West, Nigeria.

Service Quality Measures (E Vs P)		MD	t	df	*p*-value	Remark
Pair 1	Modern equipment	.116	1.237	262	.221	NS
Pair 2	Good physical facilities.	.178	.275	262	.303	NS
Pair 3	Professional appearance of maintenance staff	.246	.436	262	.211	NS
Pair 4	Visually appealing and quality materials	.186	1.107	262	.113	NS
Pair 5	Act according to promises	.904	.861	262	.410	NS
Pair 6	Sincere interest in solving problems	.186	1.277	262	.203	NS
Pair 7	Services are performed right the first time.	.585	1.150	264	.531	NS
Pair 8	Provide services at the time promised	.321	1.561	262	.253	NS
Pair 9	Keeps error free records	.842	1.782	265	.000	S

Service Quality Measures (E Vs P)		MD	t	df	*p*-value	Remark
Pair 10	Informs building users exactly when maintenance services will be provided	.108	.743	268	.458	NS
Pair 11	Provides prompt services	.541	.540	262	.341	NS
Pair 12	Always willing to help	.086	.568	262	.329	NS
Pair 13	Never too busy to respond to service requests	.651	.727	262	.274	NS
Pair 14	Maintenance staff behaviour instils confidence	.186	1.277	262	.203	NS
Pair 15	Building users feel secure in their transactions	.683	5.425	270	.000	S
Pair 16	Maintenance staff are consistently courteous	.246	.436	262	.211	NS
Pair 17	Maintenance staff have the knowledge to answer questions	.609	5.120	265	.328	NS
Pair 18	Provides individual attention	.195	1.277	262	.264	NS
Pair 19	Has convenient operating hours	.143	.965	264	.335	NS
Pair 20	Maintenance staff provide personal attention	.101	.733	266	.464	NS
Pair 21	Has the best interest of the building users at heart	.011	.083	264	.934	NS
Pair 22	Maintenance staff understand the needs of building users	-.165	-1.123	266	.262	NS

Note: Significant at *p≤0.05, S = Significant, NS= Not significant; E=Expected quality of service, P=Perceived quality of service.

Table 4.22 shows that there was generally no significant difference between the expected and perceived quality of outsourced maintenance services hence, the null hypothesis was accepted. The implication of this result is that the building users were satisfied with the quality of maintenance services delivered through outsourced maintenance practice across the tertiary institutions in South-West Nigeria. The finding of this study aligns with that of Stanimirovic (2013) that improved quality of service and better customer satisfaction are benefits that can be derived from outsourcing services.

4.7 The Perception of Maintenance Staff and Users on the Condition of Buildings in Tertiary Institutions.

This study assesses the perception of both the maintenance staff and building users on the condition of buildings in tertiary institutions within the study area. The respondents were asked to rate their perception of the physical and functional state of the various building elements and services in their buildings. This was done to ascertain the physical and functional state of key elements as well as essential services in the various tertiary institutions with a view to determining the extent to which the condition of the building elements and services are influenced by the maintenance sourcing practice(s) used for maintenance activities in the various institutions. In doing this, a list of building elements and services were presented to the respondents in two parallel columns for assessing the condition of insourced and outsourced building elements and services respectively.

The respondents were presented with a 5 point scale ranging from 1= very poor to 5= very good as the means for expressing their perception. Consequently, the mean scores from the responses were calculated. This study adopt the cut-off points of Udoekanem (2013) for the interpretation of the mean values in which $1.00 \leq MS \leq 1.49$ means very poor, $1.50 \leq MS \leq$

2.49 means poor, $2.50 \leq MS \leq 3.49$ means average, $3.50 \leq MS \leq 4.49$ means good and $4.50 \leq MS \leq 5.00$ means very good condition. Table 4.23 shows the descriptive results of the analysis of the perception of maintenance staff and users on the condition of buildings in tertiary institutions based on insourcing and outsourcing maintenance practices respectively.

The result in Table 4.23 shows that 65% of the building elements and services maintained through insourcing practice were rated by the building users to be in good condition. Maintenance staff ratings however show that about 90% of the building elements and services in the same category were in good condition. Furthermore, 97% and 87% of the building elements and services maintained through outsourcing practice were rated by the building users and maintenance staff to be in good condition respectively.

Table 4.23: Descriptive results of the perception of maintenance staff and users on the condition of buildings in tertiary institutions maintained using insourcing and outsourcing maintenance practices.

Building Elements and Services	Insourced maintenance				Outsourced maintenance			
	Users		Maintenance Staff		Users		Maintenance Staff	
	Mean	Remark	Mean	Remark	Mean	Remark	Mean	Remark
Building Fabrics								
Frames	3.50	Good	3.54	Good	3.66	Good	3.68	Good
Upper floors	3.69	Good	3.70	Good	3.60	Good	3.75	Good
Roofs	3.59	Good	3.58	Good	3.70	Good	3.65	Good
Stairs	3.69	Good	3.63	Good	3.72	Good	3.82	Good
External walls	3.63	Good	3.69	Good	3.74	Good	3.73	Good
Windows and external doors	3.62	Good	3.78	Good	3.70	Good	3.68	Good
Internal walls and partitions	3.69	Good	3.78	Good	3.72	Good	3.75	Good
Internal doors	3.59	Good	3.72	Good	3.63	Good	3.41	Average
Wall finishes	3.54	Good	3.67	Good	3.67	Good	3.59	Good
Floor finishes	3.57	Good	3.66	Good	3.69	Good	3.65	Good

Building Elements and Services	Insourced maintenance				Outsourced maintenance			
	Users		Maintenance Staff		Users		Maintenance Staff	
	Mean	Remark	Mean	Remark	Mean	Remark	Mean	Remark
Ceilings	3.56	Good	3.68	Good	3.59	Good	3.55	Good
Nettings	3.31	Average	3.71	Good	3.49	Average	3.54	Good
Building Services								
Sanitary appliances	3.34	Average	3.65	Good	3.54	Good	3.43	Average
Service equipment	3.39	Average	3.63	Good	3.53	Good	3.54	Good
Disposal installation	3.55	Good	3.58	Good	3.54	Good	3.53	Good
Water installation	3.54	Good	3.70	Good	3.63	Good	3.49	Average
Electrical installation	3.62	Good	3.82	Good	3.71	Good	3.66	Good
Gas installation	3.07	Average	3.32	Average	3.53	Good	3.70	Good
Lift and conveyor installation	2.46	Poor	2.54	Average	4.06	Good	3.97	Good
Protection installation	3.23	Average	3.55	Good	3.64	Good	3.61	Good
External services	3.45	Average	3.51	Good	3.62	Good	3.58	Good
Ventilation system	3.58	Good	3.68	Good	3.75	Good	3.65	Good
Building Environment								

Building Elements and Services	Insourced maintenance				Outsourced maintenance			
	Users		Maintenance Staff		Users		Maintenance Staff	
	Mean	Remark	Mean	Remark	Mean	Remark	Mean	Remark
Sanitation of environment	2.35	Poor	2.51	Average	4.93	V.Good	3.52	Good
Drainages	3.35	Average	3.62	Good	3.54	Good	3.50	Good
Lawns and gardens	3.74	Good	3.91	Good	3.76	Good	3.58	Good
Car park and parking lot	3.81	Good	3.87	Good	3.74	Good	3.41	Average
Building Aesthetics								
Fittings and furnishings	3.43	Average	3.58	Good	3.63	Good	3.67	Good
Internal painting	3.50	Good	3.57	Good	3.67	Good	3.63	Good
External painting	3.51	Good	3.55	Good	3.72	Good	3.64	Good
External cornices	3.48	Average	3.50	Good	3.69	Good	3.75	Good

The result in Table 4.23 shows that building elements under the building fabrics category were generally rated to be in good condition as their respective mean values fall within the range of 3.50-4.49. The only notable exception in this category was the condition of nettings which was rated by building users to be in average condition (m=3.31, 3.49). This implies that the building elements under the building fabrics category were generally perceived by the respondents to be in good condition regardless of whether they were maintained by insourcing or outsourcing practice.

In the building services category, the respondents' ratings varied from poor to good condition as the range of mean values was 2.46 to 3.97. Building services elements that were perceived to be a good condition by the respondents irrespective of the adopted maintenance sourcing practice include disposal installation ($m \geq 3.53$), electrical installation ($m \geq 3.62$) and ventilation system ($m \geq 3.58$). However, gas installations maintained through insourcing practice was rated to be in average condition while lift systems maintained through insourcing practice was rated to be in poor (m=2.46) condition by the building users.

In the building environmental services category, the respondents' ratings varied from poor to very good condition with mean values ranging from 2.35 to 4.93. The results show that the respondents perceived the sanitation of the environment maintained by insourcing practice to be poor (m=2.35) while those maintained through outsourcing were perceived to be in very good condition (m=4.93).

In the building aesthetics category, the perceived condition of the building elements varied from average to good condition. All the building aesthetics elements maintained by outsourcing were rated to be in good condition by both building users and maintenance staff.

However, only internal painting (m= 3.50, 3.57) and external painting (m= 3.51, 3.55) were perceived to be a good condition by both building users and maintenance staff under building aesthetic elements maintained through insourcing.

4.7.1 Test of Hypothesis 4

Null Hypothesis (H_0): There is no significant difference between the perception of maintenance staff and building users on the condition of buildings in tertiary institutions in South-West, Nigeria.

Alternative Hypothesis (H_1): There is significant difference between the perception of maintenance staff and building users on the condition of buildings in tertiary institutions in South-West, Nigeria.

Hypothesis four was subdivided into two. The subdivision was along the consideration of the maintenance sourcing practices of insourcing and outsourcing respectively. The following paragraphs show the analysis and results for each of the two sub-hypotheses.

4.7.1.1 Test of Sub-hypothesis 4a

Null Hypothesis (H_0): There is no significant difference between the perception of maintenance staff and building users on the condition of buildings maintained using in-sourcing practice in tertiary institutions in South-West, Nigeria.

Alternative Hypothesis (H_1): There is significant difference in the perception of maintenance staff and building users on the condition of buildings maintained using in-sourcing practice in tertiary institutions in South-West, Nigeria.

The postulated hypothesis was tested using the independent samples t test. The hypothesis seeks to establish if there was a significant difference in the perception of maintenance staff and building users on the condition of buildings maintained using in-sourcing practice in tertiary institutions in South-West Nigeria. The results of the analysis is presented in Table 4.24.

Table 4.24: Independent samples t-test of difference in the perception of maintenance staff and building users on the condition of buildings maintained using in-sourcing practice in South-West, Nigeria.

Levene's Test	**t-test for Equality of Means**				***p*-value**	**Remark**
	F	**Sig.**	**t**	**df**		
Building Fabrics	4.12	0.28	-1.04	396	0.39	NS
Building Services	1.91	0.43	-2.02	391	0.14	NS
Building Environment	0.76	0.44	-1.29	517	0.34	NS
Building Aesthetics	3.17	0.11	-0.88	336	0.47	NS
Overall	**2.73**	**0.33**	**-1.33**	**410**	**0.32**	**NS**

Note: Significant at: *p<0.05, NS = Not significant

Table 4.24 shows that the *p* value for each of the four categories of building elements was greater than 0.05 ($p > .05$). Specifically, the results shows that for; Building Fabric t (396) =-1.04, p=0.39, Building Services t (391) =-2.02, p=0.14, Building Environment t (517) =-1.29,

p=0.34 and Building Aesthetics t (336) =-0.88, *p*= 0.47. On the overall, t (410) =-1.33, *p*= 0.32. Therefore, the null hypothesis was accepted for all the categories. This implies that there is no significant difference in the perception of maintenance staff and building users on the condition of building elements and services maintained using in-sourcing maintenance practice in tertiary institutions in South-West, Nigeria.

4.7.1.2 Test of Sub-hypothesis 4b

Null Hypothesis (H_0): There is no significant difference between the perception of maintenance staff and building users on the condition of buildings maintained using outsourcing maintenance practice in tertiary institutions in South-West, Nigeria.

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Alternative Hypothesis (H_1): There is significant difference between the perception of maintenance staff and building users on the condition of buildings maintained using outsourcing maintenance practice in tertiary institutions in South-West, Nigeria.

The postulated hypothesis was tested using independent samples t-test. The hypothesis seeks to establish if there was significant difference between the perception of building users and maintenance staff on the condition of buildings maintained by outsourcing practice in tertiary institutions in South-West, Nigeria. The results of the analysis are presented in Table 4.25.

The independent samples t-test result shown in Table 4.25 indicate that for; Building Fabric t (385) = 0.09, *p*=0.59, Building Services t (389) = 0.22, *p*=0.58, Building Environment t (360) = 2.20, *p*=0.19 and Building Aesthetics t (370) = 0.04, *p*= 0.60. On the overall, t (381) = 0.41, *p*= 0.53. The results show that the *p* values for all the four categories of building elements were greater than 0.05. Therefore, the null hypothesis was accepted for each of the cases. This

implies that there is no significant difference between the perception of maintenance staff and building users on the condition of building elements and services maintained using outsourcing maintenance practice in tertiary institutions in South-West, Nigeria.

Table 4.25: Independent samples t-test of difference in the perception of maintenance staff and building users on the condition of buildings maintained using outsourcing maintenance practice in South-West, Nigeria.

Levene's Test		**t-test for Equality of Means**			***p*-value**	**Remark**
	F	**Sig.**	**t**	**df**		
Building Fabrics	0.83	0.58	0.09	385	0.59	NS
Building Services	0.43	0.68	0.22	389	0.58	NS
Building Environment	0.19	0.81	2.20	360	0.19	NS
Building Aesthetics	1.38	0.52	0.04	370	0.60	NS
Overall	**0.68**	**0.64**	**0.41**	**381**	**0.53**	**NS**

Note: Significant at: *p<0.05, NS = Not Significant

This result supports the findings of Hines (1996) that the condition of school buildings are usually on the average and oftentimes unsatisfactory. However, the study of Lewis *et al.* (2000) on the condition of schools in the United States of America show that the perceived condition of about 56% of schools was very good and satisfactory. Such report suggests that it is feasible to have buildings that are visually appealing and functionally sound in tertiary institutions in South-West Nigeria.

4.8 Test of Hypothesis 5

Null Hypothesis (H_0): The quality of insourced or outsourced maintenance services does not predict the condition of buildings in tertiary institutions in South-West Nigeria.

Alternative Hypothesis (H_1): The quality of insourced or outsourced maintenance services does predict the condition of buildings in tertiary institutions in South-West Nigeria.

For the hypothesis to be tested, two multiple linear regressions were computed using the backward stepwise regression procedure. The multiple linear regressions for the quality of maintenance services was based on insourcing and outsourcing maintenance practices respectively. The models aim at predicting the condition of building elements and services based on the quality of maintenance services for each of the maintenance sourcing practices. The output of the multiple regression analysis are shown in Table 4.26 and Table 4.27 respectively.

Table 4.26: Statistics summary of regression models predicting the condition of building elements and services based on the quality of maintenance services for insourced and outsourced maintenance practices.

Model	R	R Square	Adjusted R Square	df1	df2	*p*
PCBMI	0.579	.335	.333	1	314	.000
PCBMO	0.579	.335	.332	1	225	.000

*Note: Significant at: *p≤0.05;
PCBMI = Predicted condition of building elements and services maintained using in-sourcing practice
PCBMO = Predicted condition of building elements and services maintained using outsourcing practice
Dependent variable: the predicted condition of building elements and services.
Independent variable: Quality of maintenance services.

The result in Table 4.26 shows that F (1,314) =158.016, *p*=0.000 with an R2 of 0.335 and F (1,225) = 113.332, *p*=0.000 with an R2 of 0.335 for the two dependent variables. This implies that a significant regression equation was obtained for each of dependent variables.

The R square and the adjusted R square values (R^2=0.335, AR^2=0.33) implies that about 33% of the variance in the condition of buildings was explained by the best set of predictors. These set of predictors comprise; the use of good and up-to-date equipment, use of quality materials, getting maintenance work right the first time, neat appearance of maintenance staff, keeping accurate records and courtesy of maintenance staff. Bohm and Zech (2010) explain that the significance of R square is an indication of the effect of predictors on the dependent variable as 0.01 imply small effect, 0.09 imply medium effect and 0.25 imply high effect. Hence, the predictors (the use of good and up-to-date equipment, use of quality materials, getting maintenance work right the first time, neat appearance of maintenance staff, keeping accurate records and courtesy of maintenance staff) for both models has a high effect on the condition of buildings.

Table 4.27: Coefficients of regression models predicting the condition of building elements and services based on the quality of maintenance services for insourced and outsourced maintenance services

Model	Predictors	Unstandardized Coeff.		t	*p*
		B	Std. Error		
PCBMI	(Constant)	2.28	.03	119.83	.00
	Quality of insourced maintenance services (Q_i)	.388	.03	12.57	.00

Model	Predictors	Unstandardized Coeff.		t	*p*
		B	Std. Error		
PCBMO	(Constant)	2.25	.04	103.82	.00
	Quality of outsourced maintenance services (Q_o)	.39	.04	10.65	.00

*Note: Dependent variable: Condition of building elements and services. Independent variable: Quality of maintenance services, PCBMI= Predicted condition of building elements and services maintained using in-sourcing practice, PCBMO = Predicted condition of building elements and services maintained using outsourcing practice.

From Table 4.27, the regression equation models developed to predict the condition of building elements and services based on insourcing and outsourcing maintenance practices are:

$$\boldsymbol{PCBMI = 0.388Qi + 2.284 \ldots\ldots\ldots\ldots\ldots\ldots 4.1}$$

$$\boldsymbol{PCBMO = 0.393Qo + 2.249 \ldots\ldots\ldots\ldots\ldots\ldots 4.2}$$

Where:

PCBMI = Predicted condition of building elements and services maintained using in-sourcing practice

PCBMO = Predicted condition of building elements and services maintained using outsourcing practice

Qi = Quality of insourced maintenance services (the use of good and up-to-date equipment, use of quality materials, getting maintenance work right the first time, neat appearance of maintenance staff, keeping of accurate record and courtesy of maintenance staff)

Qo = Quality of outsourced maintenance services (the use of good and up-to-date equipment, use of quality materials, getting maintenance work right the first time, neat appearance of maintenance staff, keeping of accurate record and courtesy of maintenance staff)

To predict the condition of building elements and services using the set of models developed by this study PCBMI or PCBMO, it will be necessary to place scores on the variables Qi and Qo in the equation above. The independent variables Qi and Qo (quality of maintenance services) are to be rated on a 7 point scale ranging from 1 representing extremely dissatisfied to 7 representing extremely satisfied with respect to the perceived level of satisfaction with the maintenance staff services using quality of maintenance services indicators which comprises; the use of good and up-to-date equipment, use of quality materials, getting maintenance work right the first time, neat appearance of maintenance staff, keeping of accurate record and courtesy of maintenance staff. The resulting overall average rating should be substituted for the independent variables Qi or Qo in equation 4.1 or 4.2 depending on the condition of building elements and services to be predicted. The dependent variables outcome values range from 1 to 5 with 1 indicating a very poor condition of element or service while 5 indicate a very good condition or service.

4.8.1 Model Validation

In order to validate the models, thirty (30) questionnaires were administered to users of a sample university and polytechnic. The respondents were asked to assess the parameters of the models. Twenty-one of the questionnaires were duly completed and returned. The Mean Absolute Percentage Error (MAPE) of the responses was calculated to as a means of evaluating the fitness of the models. The analysis of data constituting the validation samples for the two models are shown in Table 4.28.

Table 4.28: Validation of predictive model for the condition of building elements and services maintained using insourcing and outsourcing practices

Samples	Insourced Maintenance			Outsourced Maintenance		
	ACBMI	**PCBMI**	**% error**	**ACBMO**	**PCBMO**	**% error**
1	2.80	2.77	1.07%	3.50	3.36	4.10%
2	3.00	3.16	5.27%	4.00	3.87	3.31%
3	3.00	2.77	7.67%	3.00	3.28	9.27%
4	3.50	2.77	20.86%	4.00	4.26	6.51%
5	2.50	2.32	7.05%	3.00	2.89	3.83%
6	2.60	2.58	0.92%	4.50	3.28	27.18%
7	3.00	3.55	18.20%	4.00	4.06	1.60%
8	3.00	2.77	7.67%	3.00	3.28	9.27%
9	3.00	3.16	5.27%	4.00	3.67	8.22%
10	3.00	2.77	7.67%	3.50	3.28	6.34%
11	3.00	3.16	5.27%	4.00	3.67	8.22%
12	3.00	2.77	7.67%	4.00	3.28	18.05%
13	3.00	3.16	5.27%	4.00	4.06	1.60%
14	3.00	3.35	11.73%	4.00	3.87	3.31%
15	2.90	3.16	8.90%	4.00	4.06	1.60%
16	2.00	2.58	28.80%	3.50	4.06	16.11%
17	3.00	2.77	7.67%	3.00	3.28	9.27%
18	4.00	3.55	11.31%	4.00	3.67	8.22%
19	3.00	2.77	7.67%	4.00	3.28	18.01%
20	3.00	3.16	5.27%	4.00	3.67	8.22%
21	3.00	2.77	7.67%	4.00	3.28	18.05%
Mean Absolute % Error (MAPE)			**8.99%**			**9.06%**

*Note: ACBMI= Perceived condition of building elements and services maintained using insourcing, PCBMI= Predicted condition of building elements and services maintained using

insourcing, ACBMO= Perceived condition of building elements and services maintained using outsourcing, PCBMO= Predicted condition of building elements and services maintained using outsourcing.

The results in Table 4.28 show that absolute percentage errors of 8.99% and 9.06% were obtained from the validation exercises for PCBMI and PCBMO respectively. The absolute percentage errors were calculated by dividing the differences between the perceived and predicted value by the perceived value and multiplying the result by one hundred (Melorose *et al*., 2015; De-Myttenaere, Golden, Le-Grand, & Rossi, 2015). The results show that the predicted outcome for the sample cases for each of the models was close to the perceived condition of the building elements and services. The results imply that performance of the models PCBMI and PCBMO were satisfactory.

4.9 The Decision Support Framework for Insourcing and Outsourcing Maintenance Services

The study developed a decision support framework to assist policy makers in tertiary institutions in the practice of insourcing and outsourcing maintenance services. The decision-support framework is shown in Figure 4.5. The decision-support framework comprises five main processes. The processes are grouped into three major phases comprising the pre-decision phase, decision phase, and post-decision phase. The decision-support framework phases are explained in the proceeding paragraphs.

4.9.1 Pre-decision Phase

The first phase of the decision-support framework is the pre-decision phase. This phase proposes the process for defining the scope of building maintenance activities based on the characteristics of the institution. During this phase, the decision maker is expected to identify

all building elements and services in the institution bearing in mind the size and magnitude of each of the building elements and services. The scope definition exercise should take into cognisance the potential influence of the institution's category (i.e. whether the institution is a university or a polytechnic) and the institution ownership (i.e. whether the institution is owned and funded by government or private entity) on the prioritising or grouping of maintenance services.

4.9.2 Decision Phase

The second phase of the decision-support framework is the decision phase. This phase proposes the process for evaluating the factors that to be considered in the decision making for the adoption of insourcing or/and outsourcing practice(s). The framework suggests that the decision maker should conduct a critical evaluation of the influencing factors and associated potential risks for each of the sourcing options. The decision-support framework proposes that the decision to insource or outsource maintenance service(s) should be based on the results of the evaluation. Consequently, it is expected that the sourcing option with the most significant set of factors should be adopted for executing the maintenance service(s) in question.

4.9.3 Post-decision Phase

The final phase of the decision-support framework is the post-decision phase. This phase focuses on processes for monitoring and controlling the quality of maintenance services in the course of maintenance activities implementation. The phase comprises of processes to ensure that satisfactory results are achieved with respect to the delivery of quality maintenance services and consequently improved the condition of the buildings.

The main processes and subprocesses in the framework are connected to each other with the aid of link arrows. The bottom-most process arrow recommends that the best sourcing practice is sustained. It also canvasses for the implementation of actions for continuous improvement of the process chain. This shows that the framework processes are cyclical. It is expected that feedbacks from the evaluation of gaps in the quality of maintenance services and the condition assessment results for building elements and services are fed into the process chain with a view to achieving optimum results.

The decision-support framework takes a clue from Mojela (2012) and Ikediashi (2014). However, the former framework was limited to highlighting the roles of various stakeholders in the maintenance of public schools in Gauteng Province of South Africa while the latter was limited to highlighting the key processes for outsourcing facilities management services in public hospitals in South-South Nigeria. The segmentation of the framework developed by this study in processes and sub processes makes this framework easily accessible to building maintenance management policy makers in tertiary institutions.

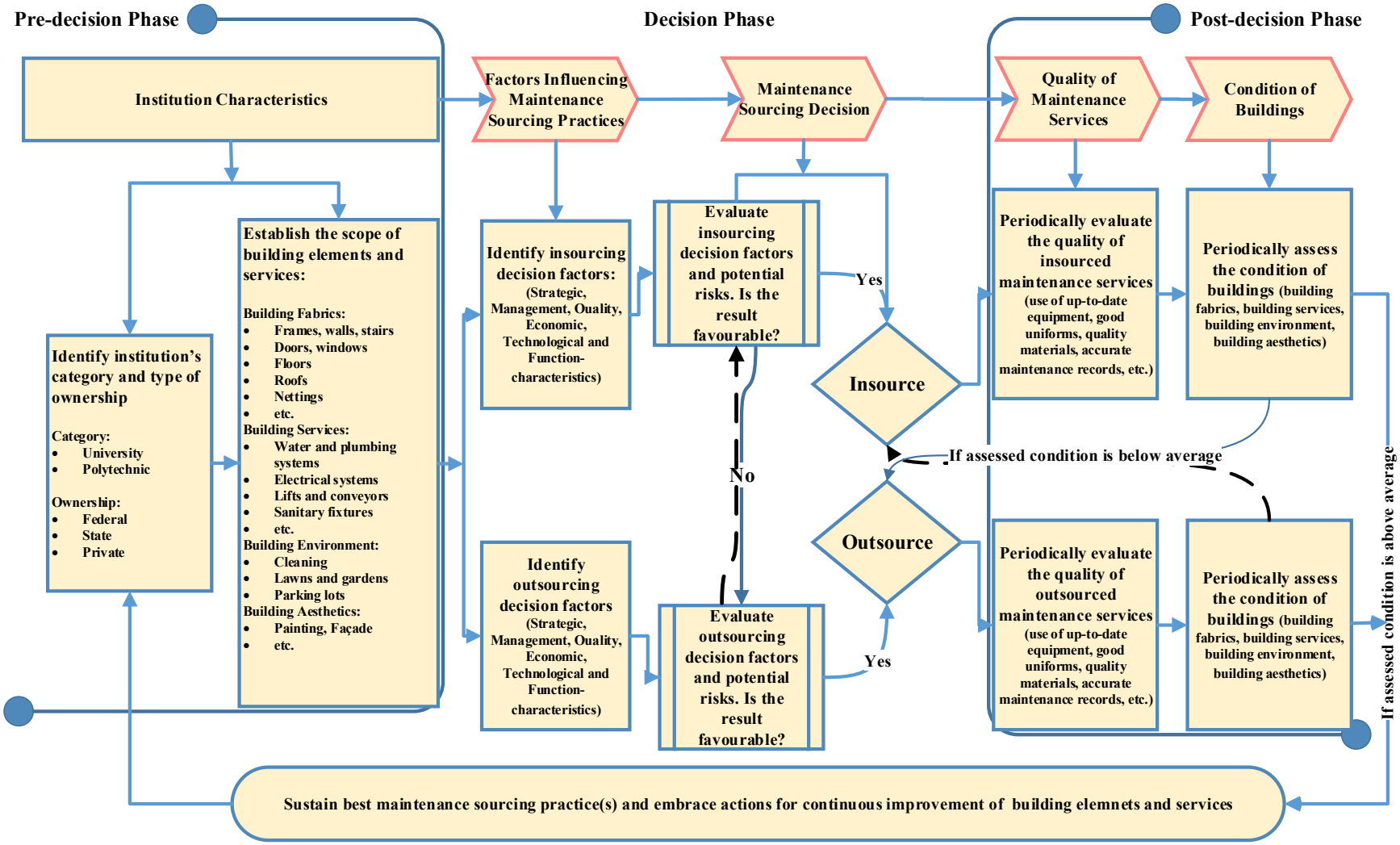

Figure 4.5: Building maintenance sourcing decision-support framework.

4.7.1 Validation of the framework

The decision-support framework was validated by facilities and maintenance management experts. Twenty-five (25) facilities and maintenance management experts were identified and selected for the validation exercise. The selected experts comprise top personnel of works and physical planning department of tertiary institutions and management staff of some of the firms providing maintenance support services in tertiary institutions within the study area.

A structured questionnaire was developed and administered for this purpose (see appendix 2 for a copy of the questionnaire). The questionnaire was administered to each of the selected experts accompanied by a printed copy of the framework with a detailed explanation of each of the processes contained in the framework. Nineteen (19) out of the twenty-five (25) selected experts responded to request for participation in the validation exercise representing a response rate of 76%. Each of the selected experts possess facilities and maintenance management experience of over ten (10) years. This suggests that the selected experts has ample years of working experience in the maintenance management of buildings. This, in turn, provides strong reliability on their judgment and are able to provide a critical and objective assessment of the decision-support framework. Each of the nineteen (19) experts validated the framework on the criteria and attribute of logical structure, clarity, and intelligibility, comprehensiveness, practicability, efficiency and applicability. The experts were presented with a 5 point scale ranging from 1=poor to 5= excellent as a means for evaluating the attributes of the framework.

Furthermore, open-ended questions were provided to the experts as a means of conducting a SWOT analysis on the framework. Figure 4.6 shows the results of the evaluation of the framework by the expert.

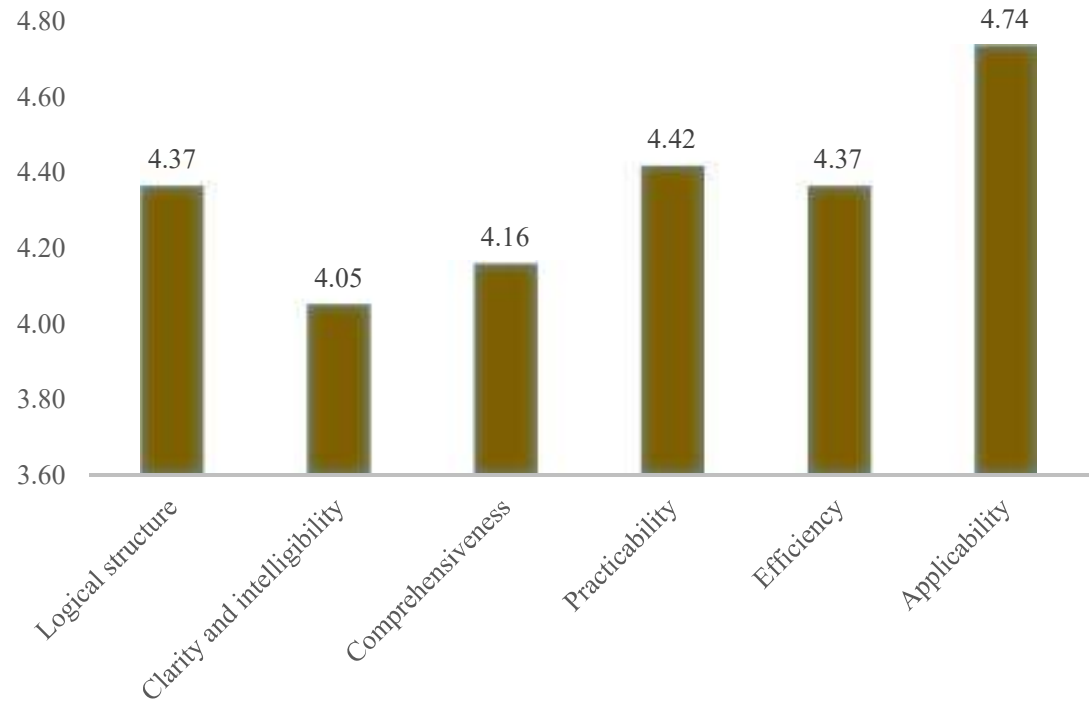

Figure 4.6: Result of framework validation

The result in Figure 4.6 shows that applicability had the highest mean score of 4.74. This implies that the framework is highly suitable for the application of the processes to maintenance management of buildings. The practicability of the framework had a mean score of 4.42. This shows that the framework comprises processes that can be easily employed when making insourcing or outsourcing decision for the maintenance management of buildings in tertiary institutions. The logical structure and efficiency of the framework jointly had a mean score of 4.37. The efficiency of the framework refers to the ability of the framework to accomplish its desired task at optimal resources utilisation while the logical structure refers to the degree to which sequencing of the processes is deemed to be suitable. The comprehensiveness of the framework had a mean score of 4.16. This refers to the degree of completeness of the framework. The clarity and intelligibility of the framework had a mean

score of 4.05. The clarity and intelligibility measure the degree to which the framework is clear, intelligent and can be easily understood.

On the overall, the result shows that the validation mean scores were generally above 4 points across the framework attributes. This indicates that the experts that validated the framework agreed that the framework possesses all necessary attributes satisfactorily. The experts indicated that the framework would provide support at improving maintenance management sourcing practices in tertiary institutions. This is because of the overall robustness and logical presentation of the processes of the framework which makes it almost perfectly intuitive and easy to use. The experts also expressed optimism that when the framework is put to use it would assist building maintenance policy makers and maintenance units of tertiary institutions in the delivery of improved maintenance services.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

Summarising the main deductions and inferences from the analysed data, this chapter presents the key findings of this study in line with its objectives.

5.2 Summary of Findings

The study showed that 43% of maintenance activities in tertiary institutions were insourced, 24% were outsourced and 33% were co-sourced, i.e. executed using a combination of insourcing and outsourcing in a hybrid arrangement. The study found that maintenance services that were frequently insourced included office cleaning, electrical systems maintenance as well as landscape and garden maintenance. Maintenance services that were frequently outsourced included CCTV system maintenance, fire protection system maintenance and lift systems maintenance. Maintenance services that were frequently co-sourced included generator maintenance, building fabrics maintenance and maintenance of air conditioner units. The Wilcoxon signed-rank test result showed that there was no significant difference in the level of use of insourcing and outsourcing maintenance practices for nearly all the categories of building maintenance services except for building environmental services.

The study showed that the decision to insource maintenance services in tertiary institutions was influenced by the need to develop in-house maintenance staff, the critical nature of maintenance activities to the operation of tertiary institutions, the difficulty in getting

trustworthy contractors, the difficulty in appraising contractor's performance, and the need for prompt and well-coordinated maintenance activities.

Predominant factors influencing outsourcing maintenance practices in tertiary institutions included the need for specialised expertise, strategic alliance with contractors, the need for specialised management, as well as accountability and lack of internal resources for maintenance activities. The Welch's ANOVA test result showed that there was no significant difference in the factors influencing insourcing or outsourcing decisions in tertiary institutions.

The result showed dissatisfaction with the quality of insourced maintenance services across the standard SERVQUAL dimensions. The only exception was for assurance, which had a score above the satisfaction threshold. The result indicated satisfaction of respondents with the level of knowledge and courtesy demonstrated by in-house maintenance staff in the discharge of maintenance activities. However, the respondents were dissatisfied with the condition of tools and equipment used by in-house maintenance staff, the promptness at which they executed maintenance activities and the ability of the maintenance staff to provide individualised attention. The result suggested that the tools and equipment used by in-house maintenance staff were old and obsolete. The paired samples t-tests results showed that there was a significant difference between the expected and perceived quality of insourced maintenance services. Consequently, the quality of maintenance services delivered through insourcing practice was unsatisfactory.

Furthermore, the respondents expressed satisfaction with the quality of outsourced maintenance services across the SERVQUAL dimensions. The dimensions that were rated above the satisfaction threshold were tangibility, responsiveness and empathy. Respondents reported a good appearance for the uniforms, equipment and work areas of outsourced maintenance staff. Furthermore, outsourced maintenance staff were reported to respond quickly, promptly, rapidly, immediately and instantly to maintenance requests. The paired samples t-tests results showed that there was no significant difference between the expected and perceived quality of outsourced maintenance services. The implication of the result was that the quality of maintenance services delivered through outsourcing practice was satisfactory.

The result showed that the perceived condition of building elements and services in tertiary institutions ranged from poor to very good. For instance, it was reported that environments sanitised through insourcing practice were in very poor conditions while those done through outsourcing practice were reported to be in very good conditions. The difference between the perception of maintenance staff and building users on the condition of tertiary institution buildings was insignificant regardless of whether they were maintained through insourcing or outsourcing practices.

The result showed a significant relationship between the quality of maintenance services and the condition of buildings. Based on this relationship, two predictive models were developed to predict the condition of buildings maintained using insourcing and outsourcing practices, viz:

(i) Predicted Condition of Building Maintained using Insourcing Practice (PCBMI) =0.388 Quality of Insourced Maintenance Services (Qi) + 2.284

(ii) (ii) Predicted Condition of Building Maintained using Outsourcing Practice (PCBMO) = 0.393 Quality of Outsourced Maintenance Services (Qo) + 2.249.

The significant relationship between the condition of buildings and the quality of maintenance services is, therefore, an indication that the condition of buildings in tertiary institutions can be improved by raising the quality of maintenance services in the institutions.

The decision-support framework comprises five processes, grouped into three phases: pre-decision, decision and post-decision. The framework showed the sequence of flow among the processes. It also provided a transition pattern from one phase to another in the building maintenance decision chain.

5.3 Conclusions

This study investigated maintenance management sourcing practices used in executing building maintenance activities in forty-three (43) tertiary institutions in South-West Nigeria. Premised on the findings of this study, the following conclusions were drawn. Firstly, insourcing, outsourcing and co-sourcing or a hybrid of insourcing and outsourcing are suitable maintenance practices for executing maintenance activities in tertiaty institutions. Topmost maintenance activities for insourcing include; office cleaning, electrical system maintenance, and landscape and garden maintenance while topmost maintenance activities for outsourcing include generator maintenance, painting and CCTV maintenance.

Secondly, strategic, management and technological factors influence the decision of policy makers in tertiary institutions to insource maintenance activities. The most significant factors include; the need to develop maintenance in-house staff, the criticality of maintenance activities in the preservation of tertiary institutions' building stock (maintenance as a core activity to institutions), the difficulty in getting trustworthy outsourcing contractors and the difficulty in appraising subcontractor's performance, as well as the need to initiate innovative ideas and techniques among in-house maintenance staff.

Thirdly, strategic, quality and management factors influence the decision of policy makers in tertiary insitutions to outsource maintenance activities. The most significant factors include; the need for specialised expertise, the need for strategic alliance with contractors, the need for improved service quality, the need for improved quality requirements, the need for specialised management, and the need to manage difficult maintenance activities.

Fourthly, building users were more dissatisfied with the quality of maintenance services delivered through insourcing practice than with the quality of outsourced maintenance services. The condition of building elements and services were generally above average. However, building elements and services maintained using outsourcing practice had better conditions than those maintained using insourcing practice. Also, significant relationships exist between the condition of buildings and the quality of building maintenance services. Therefore, this study concludes that the condition of building elements and services can be predicted by the quality of maintenance services.

Based on its practical implications and to underscore its significance, this study developed a decision support framework to assist policymakers and maintenance managers of tertiary

institutions in surmounting the complex task of deciding whether to insource or outsource maintenance services. The framework is useful for maintenance managers and policymakers in the decision-making process of choosing the most effective sourcing practice for each of the maintenance services in their portfolio. Moreover, the study also provides dominant factors to be assessed when considering building maintenance services for insourcing or outsourcing. It also established quality indicators for evaluating the quality of maintenance services in tertiary institutions.

5.4 Recommendations

Based on its findings, the study recommends as follows:

(i) Maintenance managers of tertiary instiutions should deligently assess the building maintenance needs in their respective institutions with a view to achieving detailed maintenance scope for the institutions.

(ii) The decision to insource or outsource maintenance services should be made after adequate process evaluation of the dominant factors influencing maintenance insourcing and outsourcing practices.

(iii) Maintenance managers and maintenance technical staff should focus on each of the significant quality indicators of maintenance services that constitute the component of the predictors (the use of good and up-to-date equipment, use of quality materials, getting maintenance work done right the first time, neat appearance of maintenance staff, keeping of accurate record and courteous behaviour by maintenance staff) for the predictive models. These indicators should

be adopted as indices for assessing the quality of services delivered by maintenance staff, such that every maintenance staff would consider each of the indicators as a target to be aimed for at all time.

(iv) Frequent condition assessment and user satisfaction surveys on the quality of maintenance services should be conducted by those responsible for the maintenance management of buildings in tertiary institutions. These steps would provide the much needed feedback to drive actions for the overall improvement of the buildings.

(v) In-house maintenance crew should be properly equipped in order to improve the quality of insourced maintenance service delivery. Tools and equipment used for maintenance activities should be periodically audited. Such audit should be aimed at replacing old, worn-out, and outdated tools and equipment to enhance the quality of insourced maintenance services.

(vi) Janitorial services executed through insourced maintenance practice should be better supervised. It is expected that better environmental sanitation can be achieved through improved supervision of insourced janitorial activities.

5.5 Contributions to Knowledge

The study has made the following contributions to knowledge:

(i) a decision support framework to assist policymakers in tertiary institutions to make informed insourcing or outsourcing decision on the maintenance management of building elements and services was developed;

(ii) models were developed for predicting the condition of buildings in tertiary institutions;

(iii) the study established dominant factors influencing insourcing (the need to develop in-house staff, difficulty in getting trusthworthy outsourced contractors and appraising their performance among others) and outsourcing (the need for specialised expertise, the need for strategic alliance with contractors and the need for improved quality of service among others) decisions for building maintenance services in tertiary institutions; and

(iv) the study established key quality indicators for the maintenance of buildings in tertiary institutions.The key quality indicators include; the use of good and up-to-date equipment, use of quality materials and getting maintenance work right at the first time.

5.6 Recommendations for Further Research

The findings of this study provide possible directions for future research as follows:

(i) This study specifically investigated maintenance management insourcing and outsourcing practices in South-West Nigeria. Studies in the other five geopolitical zones of the country can be carried out to discover the prevailing situations in those regions. Comparative studies can also be done between the geopolitical zones in Nigeria.

(ii) A qualitative research can be conducted to investigate the extent to which the conditions of tertiary institution buildings are influenced by the choice of maintenance sourcing practices.

(iii) This study can be extended to other types of public institution buildings to examine the relationship between adopted sourcing practices and the condition of buildings.

(iv) There are secondary schools in Nigeria with large infrastructure; therefore, this study can be replicated in such schools.

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APPENDICES

- **Questionnaires**
- **SPSS Analysis Output**

Maintenance Staff Questionnaire

MAINTENANCE STAFF QUESTIONNAIRE

University of Lagos,
Akoka-Yaba,
Lagos.

July, 2016.

……

……

……

Dear Sir/Ma,

RESEARCH QUESTIONNAIRE ON SOURCING OF BUILDING MAINTAINANCE SERVICES IN TERTIARY INSTITUTIONS

This questionnaire is designed to study building maintenance management insourcing and outsourcing practices in tertiary institutions in South West Nigeria. The study is solely meant for academic research and the result will be of benefit to all stakeholders responsible for maintenance management of buildings in tertiary institutions and maintenance and facilities management industry at large. Your participation in this data collection process will be immensely appreciated. Confidentiality of your response is assured and your anonymity is guaranteed, as results will be presented in group data form.

Thank you.

SECTION A

GENERAL INFORMATION

Please fill or tick as appropriate.

1. Name of Institution: _____
2. Institution Category: Kindly tick the appropriate box below

Category	Ownership		
	Federal	State	Private
University			
Polytechnic			

3. In which state is your institution located?

   Lagos [ ] Ogun [ ] Ondo [ ] Oyo [ ] Osun [ ] Ekiti [ ]
4. Gender: Male [ ] Female [ ]
5. Name of your department ……..
6. Your present position in your department ……
7. For how long have you been in this department? .....

   Less than 5yrs [ ] 6-10yrs [ ] 11-15yrs [ ] 16-20yrs [ ] 21-25yrs [ ] Above 25 yrs. [ ]
8. What is your highest level of education?

   OND [ ] HND [ ] BSC [ ] MSC [ ] PhD [ ] Others (Specify)
9. Which of the following professional bodies do you belong?

   NIA [ ] NIOB [ ] NSE [ ] NIEVS [ ] NITP [ ] NIQS [ ]
10. Approximately how many full time employees do you have in your department?

    1-5 [ ] 6-10 [ ] 11-15 [ ] 16-20[ ] 21-25[ ] Above 25 [ ]

SECTION B

LEVEL OF USE OF SOURCING STRATEGIES FOR BUILDING MAINTENANCE SERVICES

1. Kindly assess the level of the use of insourcing or/and outsourcing of maintenance services in your institution. Please use the scale 1=Never use, 2=Almost never use, 3=Sometimes use, 4=Often use, 5=Always use

- **Insourcing**: refers to the arrangement in which personnel carrying out maintenance works are staff of the institution that are directly employed by the institution into the maintenance or works department/unit.
- **Outsourcing**: refers to the arrangement in which personnel carrying out maintenance works are not staff of the institution but of third party vendor(s) engaged to carry out maintenance works in the institution.
- **Hybrid**: refers to the arrangement in which part of the maintenance works are carried out by staff of third party vendor(s) while the remaining part are done by maintenance staff of the institution.

MAINTENANCE SERVICES	INSOURCING					OUTSOURCING				
	1	2	3	4	5	1	2	3	4	5
BUILDING FABRICS										
Civil works and building fabrics										
SERVICES										
Electrical maintenance										
Air-conditioners maintenance										
Generators maintenance										
Water System and borehole maintenance										
Water treatment plant										
Lift system maintenance										
CCTV Cameras maintenance										
Plumbing systems maintenance										
Intercom systems										
Internet services installations										
Fire protection systems										
Sewage evacuation and disposal										
ENVIRONMENT										
Office cleaning										
Classrooms cleaning										
Common areas cleaning (Toilets, corridors, stairs, etc.)										
Refuse and waste disposal										
Fumigation services										
AESTHETIC										
Landscape and Gardens										
Internal painting										
External painting										
Others (please specify)										

2. From your experience, kindly assess the preferred choice of sourcing strategy used in executing the following maintenance services in your institution.

MAINTENANCE SERVICES	INSOURCING	OUTSOURCING	HYBRID
BUILDING FABRICS			
Civil works and building fabrics			
SERVICES			
Electrical maintenance			
Air-conditioners maintenance			
Generators maintenance			
Water System and borehole maintenance			
Water treatment plant			
Lift system maintenance			
CCTV Cameras maintenance			
Plumbing systems maintenance			
Intercom systems			
Internet services installations			
Fire protection systems			
Sewage evacuation and disposal			
ENVIRONMENT			
Office cleaning			
Classrooms cleaning			
Common areas cleaning (Toilets, corridors, stairs, etc.)			
Refuse and waste disposal			
Fumigation services			
AESTHETIC			
Landscape and Gardens			
Internal painting			
External painting			
Others (please specify)			

FACTORS INFLUENCING DECISION TO INSOURCE OR OUTSOURCE MAINTAINANCE MANAGEMENT OF BUILDINGS

3. From your wealth of experience with maintenance operations in tertiary institutions, kindly rate the influence of each of the following factors in influencing decision to insource or outsource building maintenance services in tertiary institutions. Using the scale 1-5 with;

1= Not at all influential, 2= Slightly influential, 3= Somewhat influential, 4= Very influential, 5=Extremely influential

Factors influencing maintenance sourcing decision	Insourcing					Outsourcing				
	1	2	3	4	5	1	2	3	4	5
Strategic Factors										
Developing internal staff										
Maintenance is core to institution										
Potential damage to reputation of institution										
Accelerate re-engineering benefits										
Regulations governing outsourcing practices										
Improve flexibility to the changing market dynamics										
Strategic alliance with contractors										
Freeing resources for core activities										
Risk sharing with contractors										
Focus on core activities										
Access to world class capabilities										
Management Factors										
Difficulty in appraising subcontractor's performance										
Difficulty in getting trustworthy subcontractors										
Timing and coordination of maintenance activities										
Potential conflict of interest between subcontractor and institution										
Difficulty of getting subcontractors with compatible organisation culture										
Safety management										
Consolidation and decentralisation										
Function difficult to manage and control										
Increase the speed of implementation										
Reduce management load										
Save management time										
Need for specialised management										
Economic Factors										
Economies of scale										
Potential loss of investments										
Cash infusion										
Accountability										
Transform fixed cost into variable costs										

Factors influencing maintenance sourcing decision	Insourcing					Outsourcing				
	1	2	3	4	5	1	2	3	4	5
Increase the economic efficiency										
Improve the cash flow										
Make capital funds more available for core activities										
Overall maintenance cost reduction										
Quality Factors										
Improve process responsiveness and cycle time										
Procure higher reliability and competency										
Improve quality requirements										
Improve service quality										
Achieve high quality of service for competitive advantage										
Technological Factors										
Initiate innovative ideas and techniques										
Improve the technology for competitive advantage										
Acquire new skills or technical knowledge										
Need for specialised expertise										
Achieve flexibility with changing technology										
Technology requirements uncertainty										
Function Characteristics Factors										
Complexity of function										
Difficulty in contracting unpredictable activities										
Lack of spare parts										
Lack in equipment /tools availability										
Function integration and structure										
Lack of internal resources for a service										

OPERATIONAL STATE OF BUILDING ELEMENTS AND SERVICES

4. Kindly assess the condition of the following building elements and services with respect to the type of sourcing arrangement used for executing required maintenance services in your institution? Please use the scale 1=Very Bad, 2= Bad, 3=Average, 4=Good, 5=Very Good

BUILDING ELEMENTS AND SERVICES	INSOURCED MAINTENANCE					OUTSOURCED MAINTENANCE				
	1	2	3	4	5	1	2	3	4	5
BUILDING FABRIC										
Frames (Columns and Beams)										
Upper floors										
Roofs										
Stairs										
External walls										
Windows and External doors										
Internal walls and partitions										
Internal doors										
Wall finishes										
Floor finishes										
Ceilings										
Nettings										
SERVICES										
Sanitary appliances										
Services equipment										
Disposal installation										
Water installation										
Electrical Installation										
Gas Installation										
Lift and conveyor installation										
Protection installation										
Drainages										
External Services										
Ventilation System										
ENVIRONMENT										
General sanitation of the environment										
Lawns and Gardens										
Car park and parking lots										
AESTHETIC										

BUILDING ELEMENTS AND SERVICES	INSOURCED MAINTENANCE					OUTSOURCED MAINTENANCE				
	1	2	3	4	5	1	2	3	4	5
Fittings and Furnishings										
Internal painting										
External painting										
External cornices on Façades										

Thank You.

Building Users Questionnaire

BUILDING USERS' QUESTIONNAIRE

University of Lagos,
Akoka-Yaba,
Lagos.

July, 2016.

……

……

……

Dear Sir/Ma,

RESEARCH QUESTIONNAIRE ON SOURCING OF BUILDING MAINTAINANCE SERVICES IN TERTIARY INSTITUTIONS

This questionnaire is designed to study building maintenance management insourcing and outsourcing practices in tertiary institutions in South West Nigeria. The study is solely meant for academic research and the result will be of benefit to all stakeholders responsible for maintenance management of buildings in tertiary institutions and maintenance and facilities management industry at large. Your participation in this data collection process will be immensely appreciated. Confidentiality of your response is assured and your anonymity is guaranteed, as results will be presented in group data form.

Thank you.

SECTION A

GENERAL INFORMATION

Please fill or tick as appropriate.

1. Name of Institution _____
2. Institution Category:

Category	Ownership		
	Federal	State	Private
University			
Polytechnic			

3. In which state is your institution located?
   Lagos [ ] Ogun [ ] Ondo [ ] Oyo [ ] Osun [ ] Ekiti [ ]
4. Status: Academic staff [ ] Administrative staff [ ] Management staff [ ] Others [ ]
5. Designation…….
6. Gender: Male [ ] Female [ ]
7. Age: Less than 20yrs [ ] 21-30yrs [ ] 31-40yrs [ ] 41-50yrs [ ] Above 50 yrs. [ ]
8. For how long have you been in this institution?
   Less than 5yrs [ ] 6-10yrs [ ] 11-15yrs [ ] 16-20yrs [ ] 21-25yrs [ ] Above 25 yrs. [ ]

SECTION B

OPERATIONAL STATE OF BUILDING ELEMENTS AND SERVICES

1. Kindly assess the condition of the following building elements and services with respect to the type of sourcing arrangement used for executing required maintenance services in your institution? Please use the scale 1=Very Bad, 2= Bad, 3=Average, 4=Good, 5=Very Good

   Insourcing: refers to the arrangement in which personnel carrying out maintenance works are staff of the institution that are directly employed by the institution into the maintenance or works department/unit.

   Outsourcing: refers to the arrangement in which personnel carrying out maintenance works are not staff of the institution but of third party vendor(s) engaged to carry out maintenance works in the institution.

BUILDING ELEMENTS AND SERVICES	INSOURCED MAINTENANCE					OUTSOURCED MAINTENANCE				
	1	2	3	4	5	1	2	3	4	5
BUILDING FABRIC										
Frames (Columns and Beams)										
Upper floors										

BUILDING ELEMENTS AND SERVICES	INSOURCED MAINTENANCE					OUTSOURCED MAINTENANCE				
	1	2	3	4	5	1	2	3	4	5
Roofs										
Stairs										
External walls										
Windows and External doors										
Internal walls and partitions										
Internal doors										
Wall finishes										
Floor finishes										
Ceilings										
Nettings										
SERVICES										
Sanitary appliances										
Services equipment										
Disposal installation										
Water installation										
Electrical Installation										
Gas Installation										
Lift and conveyor installation										
Protection installation										
Drainages										
External Services										
Ventilation System										
ENVIRONMENT										
General sanitation of the environment										
Lawns and Gardens										
Car park and parking lots										
AESTHETIC										
Fittings and Furnishings										
Internal painting										
External painting										
External cornices on Façades										

FACTORS INFLUENCING DECISION TO INSOURCE OR OUTSOURCE MAINTAINANCE MANAGEMENT OF BUILDINGS

2. From your wealth of experience with maintenance operations in tertiary institutions, kindly rate the influence of each of the following factors in influencing decision to insource or outsource building maintenance services in tertiary institutions. Using the scale 1-5 with; 1= Not at all influential, 2= Slightly influential, 3= Somewhat influential, 4= Very influential, 5=Extremely influential

Factors influencing maintenance sourcing decision	**Insourcing**					**Outsourcing**				
	1	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
Strategic Factors										
Developing internal staff										
Maintenance is core to institution										
Potential damage to reputation of institution										
Accelerate re-engineering benefits										
Regulations governing outsourcing practices										
Improve flexibility to the changing market dynamics										
Strategic alliance with contractors										
Freeing resources for core activities										
Risk sharing with contractors										
Focus on core activities										
Access to world class capabilities										
Management Factors										
Difficulty in appraising subcontractor's performance										
Difficulty in getting trustworthy subcontractors										
Timing and coordination of maintenance activities										
Potential conflict of interest between subcontractor and institution										
Difficulty of getting subcontractors with compatible organisation culture										
Safety management										
Consolidation and decentralisation										
Function difficult to manage and control										
Increase the speed of implementation										
Reduce management load										
Save management time										
Need for specialised management										

Factors influencing maintenance sourcing decision	Insourcing					Outsourcing				
	1	2	3	4	5	1	2	3	4	5
Economic Factors										
Economies of scale										
Potential loss of investments										
Cash infusion										
Accountability										
Transform fixed cost into variable costs										
Increase the economic efficiency										
Improve the cash flow										
Make capital funds more available for core activities										
Overall maintenance cost reduction										
Quality Factors										
Improve process responsiveness and cycle time										
Procure higher reliability and competency										
Improve quality requirements										
Improve service quality										
Achieve high quality of service for competitive advantage										
Technological Factors										
Initiate innovative ideas and techniques										
Improve the technology for competitive advantage										
Acquire new skills or technical knowledge										
Need for specialised expertise										
Achieve flexibility with changing technology										
Technology requirements uncertainty										
Function Characteristics Factors										
Complexity of function										
Difficulty in contracting unpredictable activities										
Lack of spare parts										
Lack in equipment /tools availability										
Function integration and structure										
Lack of internal resources for a service										

ASSESSMENT OF THE QUALITY OF BUILDING MAINTENANCE SERVICES

3. This section is in three parts; your expectations of maintenance services, experience/perception of maintenance services and the importance of features pertaining to maintenance crew and the services they render.

Part 1- Expectations: This section deals with your opinion of maintenance crew and their services in your institution. Please, show the extent to which you think maintenance crew 'should' possess the following features. We are interested in knowing your expectations from maintenance crew in a tertiary institution. You should rank each statement as follows;

Very low expectation Extremely high expectation

1 2 3 4 5 6 7

Kindly tick on your choice of answer

SN	STATEMENT	INSOURCED							OUTSOURCED						
		1	2	3	4	5	6	7	1	2	3	4	5	6	7
1	They should have up-to-date equipment														
2	Their physical facilities should be visually appealing														
3	Their employees should be well dressed and appear neat														
4	The appearance of the physical facilities of these units should be in keeping with the type of services provided														
5	When these unit promises to do something by a certain time, they should do so														
6	When customers/users of the building have problems, these units should be sympathetic and reassuring														
7	These units should be dependable														
8	They should provide their services at the time they promise to do so.														
9	They should keep their records accurately														
10	They shouldn't be expected to tell users exactly when services will be performed. (-)														
11	It is not realistic for users to expect prompt service from employees of these units. (-)														
12	Their employees don't always have to be willing to help users. (-)														
13	It is okay if they are too busy to respond to users requests promptly. (-)														
14	Users should be able to trust employees of these units														
15	Users should be able to feel safe in their transactions with these units' employees														

SN	STATEMENT	INSOURCED							OUTSOURCED						
		1	2	3	4	5	6	7	1	2	3	4	5	6	7
16	Their employees should be polite														
17	Their employees should get adequate support from these units to do their jobs well														
18	These units should not be expected to give users individual attention. (-)														
19	Employees of these units cannot be expected to give users personal attention. (-)														
20	It is unrealistic to expect employees to know what the needs of their customers are. (-)														
21	It is unrealistic to expect these units to have their customers' best interests at heart. (-)														
22	They shouldn't be expected to have operating hours convenient to all their customers/users of the building. (-)														

Part 2- Perceptions: The following set of statements relate to your feelings about the maintenance unit in your institution. For each statement, please show the extent to which you believe the maintenance unit has the feature described by the statement. Once again, ticking a 7 means that you strongly agree that the maintenance unit has that feature, and ticking a 1 means that you strongly disagree. You may tick any of the numbers in the middle that show how strong your feelings are. There are no right or wrong answers. All we are interested in is a number that best shows your perceptions about the maintenance unit.

SN	STATEMENT	INSOURCED							OUTSOURCED						
		1	2	3	4	5	6	7	1	2	3	4	5	6	7
1	Maintenance unit has up-to-date equipment														
2	Maintenance unit's physical facilities are visually appealing														
3	Maintenance unit's employees are well dressed and appear neat														
4	The appearance of the physical facilities of maintenance unit is in keeping with the type of services provided														
5	When maintenance unit promises to do something by a certain time, it does so														
6	When you have problems, maintenance unit is sympathetic and reassuring														
7	Maintenance unit is dependable														
8	Maintenance unit provides its services at the time it promises to do so														

SN	STATEMENT	INSOURCED							OUTSOURCED						
		1	2	3	4	5	6	7	1	2	3	4	5	6	7
9	Maintenance unit keeps its records accurately														
10	Maintenance unit does not tell customers exactly when services will be performed. (-)														
11	You do not receive prompt service from maintenance unit's employees. (-)														
12	Employees of maintenance unit are not always willing to help customers. (-)														
13	Employees of maintenance unit are too busy to respond to customer requests promptly. (-)														
14	You can trust employees of maintenance unit														
15	You feel safe in your transactions with maintenance unit's employees														
16	Employees of Maintenance unit arc polite														
17	Employees get adequate support from maintenance unit to do their jobs well.														
18	Maintenance unit does not give you individual attention. (-)														
19	Employees of maintenance unit do not give you personal attention. (-)														
20	Employees of maintenance unit do not know what your needs are. (-)														
21	Maintenance unit does not have your best interests at heart. (-)														
22	Maintenance unit does not have operating hours convenient to all their customers. (-)														

Part 3- Feature Ranking

Listed below are five features pertaining to maintenance crew and the service they render. Kindly rate how important each of these features is to you when you evaluate the service offered by maintenance crew. Please allocate a total of 100 points among the five features according to how important each feature is to you - the more important a feature is to you, the more points you should allocate to it. **Please ensure that the points you allocate to the five features add up to 100.**

1. The appearance of the maintenance unit's physical facilities, equipment and personnel ……. POINTS

2. The maintenance unit's ability to perform the promised service dependably and accurately. ……. POINTS

3. The maintenance unit's willingness to help users/customers and provide a prompt ……. POINTS

service.

4. The knowledge and courtesy of the maintenance unit's personnel and their ability to convey trust and confidence ……. POINTS

5. The caring, individualized attention the maintenance unit provides users/ its customers ……. POINTS

Total Points Allocated ……. POINTS

Which one feature of the above five is the most important to you? (Please enter the feature's number) ……..

Which feature is the second most important to you? ……..

Which feature is the least important to you? ……..

Thank You.

Framework Validation Questionnaire

Framework validation Questionnaire

Department of Building, University of Lagos,
Lagos.
24th June, 2017

Dear Sir/Ma,

Please find attached a copy of the decision support framework for insourcing or/and outsourcing maintenance services. The framework was developed as part of an ongoing Ph.D. research work. I will appreciate if you could spare some time to share your knowledge and experience by providing your assessment of the framework.

Be assured that your participation is highly valued and absolutely necessary while your privacy and anonymity are guaranteed, as results will be presented in group data form.

Yours Sincerely,

Faremi J.O

Personal Information

Please fill or tick as appropriate.

1. Name of your institution/organisation……..
2. Kindly state your position/designation……..
3. Gender: Male [ ] Female [ ]
4. Your years of professional experience: 0-10yrs [ ] 11-20yrs [ ] 21-30yrs [ ] above 30yrs [ ]

Framework validation

5. Please indicate your overall assessment of the decision-support framework using the scale of 1= poor; 2= below average, 3= moderate, 4= above average and 5= excellent.

ATTRIBUTES	1	2	3	4	5
Logical structure					
Clarity and intelligibility					
Comprehensiveness					
Practicability					

ATTRIBUTES	1	2	3	4	5
Efficiency					
Applicability					

6. Please identify potential limitation/weaknesses observed in the framework

   ……

   ……

   ……

   ……

7. Please identify possible areas of strength and opportunities in the framework

   ……

   ……

   ……

   ……..

8. Kindly provide any other suggestion(s) that may further improve the quality of the framework

   ……

   ……

   ……

   ……

   ……..

Thank You.

Predictive Model Validation Questionnaire

Department of Building, University of Lagos,
Lagos.
June, 2017

Dear Sir/Ma,

The few questions in this questionnaire are designed to study building maintenance management insourcing and outsourcing practices in tertiary institutions in South West Nigeria. Your participation in this data collection process will be immensely appreciated. Confidentiality of your response is assured and your anonymity is guaranteed, as results will be presented in group data form.

Please fill or tick as appropriate.

1. Name of Institution _____
2. Institution Category:

Category	Ownership		
	Federal	State	Private
University			
Polytechnic			

3. Gender: Male [ ] Female [ ]
4. Age: Less than 20yrs [ ] 21-30yrs [ ] 31-40yrs [ ] 41-50yrs [ ] Above 50 yrs. [ ]
5. For how long have you been in this institution?
   Less than 5yrs [ ] 6-10yrs [ ] 11-15yrs [ ] 16-20yrs [ ] 21-25yrs [ ] Above 25 yrs. [ ]
6. Kindly rate your perceived condition of your building elements/services maintained using in-house maintenance crew (please use the scale 1.00 to 5.00 where 1.00 represent very poor and 5.00 represent very good). …….
7. Kindly rate your perceived condition of your building elements/services maintained using outsourced maintenance crew (please use the scale 1.00 to 5.00 where 1.00 represent very poor and 5.00 represent very good). …….
8. Please rate the extent to which you believe the maintenance unit/crew possess the attributes described below. Kindly use the scale scale 1.00 to 7.00 where 1.00 represent very low and 7.00 represent extremely high

Attributes	In-house maintenance crew	Outsourced maintenance crew
Competence (maintenance crew; has good and up-to-date equipment, are well dressed and appears neat, use quality materials)		
Customer service (The maintenance unit's ability to perform the promised service dependably and accurately, performing the service right the first time)		
Assurance (maintenance crew; has knowledge of task and are courteous, possess ability to convey trust and confidence)		

Thank You.

SPSS Wilcoxon Signed Ranks Test Output

Wilcoxon Signed Ranks Test Output

```
NPAR TESTS
  /WILCOXON=BFI BSI BEI BAI WITH BFO BSO BEO BAO (PAIRED)
  /STATISTICS DESCRIPTIVES
  /MISSING ANALYSIS.
```

NPar Tests

```
[DataSet1] C:\Users\Julius Faremi\Google Drive\Ph.D\PhD Data\Final PhD Thesis Data.sav
```

Descriptive Statistics

	N	Mean	Std. Deviation	Minimum	Maximum
BFI	163	.5460	.49941	.00	1.00
BSI	205	3.6475	.91783	1.00	5.00
BEI	203	4.0340	1.01124	1.00	5.00
BAI	156	3.5417	1.22601	1.00	5.00
BFO	139	.5899	.49363	.00	1.00
BSO	171	3.5633	1.00015	1.00	5.00
BEO	162	3.4995	1.21022	1.00	5.00
BAO	145	3.8207	1.15572	1.00	5.00

Wilcoxon Signed Ranks Test

Ranks

		N	Mean Rank	Sum of Ranks
BFO - BFI	Negative Ranks	23[a]	26.50	609.50
	Positive Ranks	29[b]	26.50	768.50
	Ties	52[c]		
	Total	104		
BSO - BSI	Negative Ranks	87[d]	72.80	6334.00
	Positive Ranks	62[e]	78.08	4841.00
	Ties	15[f]		
	Total	164		
BEO - BEI	Negative Ranks	84[g]	68.62	5764.00
	Positive Ranks	42[h]	53.26	2237.00
	Ties	30[i]		
	Total	156		
BAO - BAI	Negative Ranks	39[j]	32.97	1286.00
	Positive Ranks	36[k]	43.44	1564.00
	Ties	21[l]		
	Total	96		

a. BFO < BFI

b. BFO > BFI

c. BFO = BFI

d. BSO < BSI

e. BSO > BSI

f. BSO = BSI

g. BEO < BEI

h. BEO > BEI

i. BEO = BEI

j. BAO < BAI

k. BAO > BAI

l. BAO = BAI

Test Statistics[a]

	BFO - BFI	BSO - BSI	BEO - BEI	BAO - BAI
Z	-.832[b]	-1.415[c]	-4.294[c]	-.739[b]
Asymp. Sig. (2-tailed)	.405	.157	.000	.460

a. Wilcoxon Signed Ranks Test

b. Based on negative ranks.

c. Based on positive ranks.