DEVELOPMENT OF A SYSTEM MODEL FOR COST MANAGEMENT IN LOW-COST HOUSING PROJECTS IN NIGERIA

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DECLARATION

This thesis is submitted for the award of a PhD degree by research under the University of Salford rules and regulations. I declare that I am responsible for the work reported in this thesis. Furthermore, I can confirm that no portion of the work in this thesis has been submitted for another degree qualification in any other university.

Lovelin Ifeoma Obi

January, 2017

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LIST OF ABBREVIATIONS

CMS- Project Cost management System (s)

PMT- Project Managemet Team(s)

EVA- Earn value analysis

TVD- Target value design

TC- Target costing

FMLHUD- Federal Ministry of Lands, Houisng and Urban Development

UN- United Nations

UK- United Kingdom

USA- United States of America

IMSF- Implementation Success Factors

CE- Cost estimating

ONSR- On-site resource control

ABC- Activiy base costing

VE- Value engineering

LcH- Low-cost Housing

HAST- Housing agency supervisory team

CST- Consultants management team

CNT- Contractor management team

ACA- Academia

CMSM- Cost Management System Model

LcH- Low-cost Housing

NHP- National Housing Policy

SHP-Structure of Housing Provision

NBS- National Bureau of Statistics in Nigeria

DEDICATION

This work is dedicated to the

Almighty God

and

In loving memory of my dearest mother

Ezinne Dr (Mrs) B.C Anyama.

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ABSTRACT

Poor project cost performance is one of the vital issues challenging successful construction project delivery particularly in developing countries such as Nigeria. This issue is endemic particularly in Low-cost housing (LcH) projects with adverse effects on delivery, affordability of the target beneficiaries and housing situations in Nigeria. Past studies highlight the relationship between project cost management systems (CMS) and cost performances. However, extensive studies exploring the CMS for LcH project delivery in Nigeria are rare. Apparently, no contemporary attempts are made to proffer appropriate and well-developed systematic solutions indicating possible continuing trends of poor cost management and performances in LcH project delivery. Given this discovery, this research seeks to develop a cost management system model (CMSM) for LcH project delivery in Nigeria.

Empirical investigations explore the concepts of LcH project delivery, project cost management system (CMS) and implementation success factors (IMSF). The research leans towards an interpretivism perspective. It adopts a case study strategy and employs a sequential mixed method procedure for data collection and analysis at different phases of the research. A mix of focus group, semi-structured interviews, and questionnaires facilitated data collection and thematic- content analysis and statistical analysis (percentages, relative agreement index, Kruskal-Wallis, and exploratory factor analysis) for data analysis.

Research findings reveal that popular CMS employed by the Project Management Teams (PMT) are incapable of delivering effective LcH project cost performances following three key constraints: difficulty to effectively set target cost, plan and perform real-time project cost monitoring and control, creating rooms for variations and overruns. These limitations were traceable to inappropriate use of cost management techniques, process approach alongside 18 implementation barriers. Integrating Target costing, Earn value analysis, a cost-design-control process approach and consideration of three key IMSF namely effective team qualities, effective information and management actions and stable operational environment were identified measures to improve current CMS efficacy.

The research findings were used to develop the CMSM and its operational guide employing three modelling techniques: conventional process modelling, interpretive structural modelling (ISM) and the interpretive ranking process (IRP). These modelling techniques enhanced the design and understanding of the contextual relationships between the techniques, process, and IMSF in the CMS. The IRP and ISM used in this study are novel contributions to construction research, particularly in the area of LcH project cost management. The validation of the CMSM shows its capability to facilitate improved project cost management towards effective cost performances of LcH projects. The CMSM will assist the PMT to set effectively, plan, monitor, and control costs in LcH project delivery in Nigeria.

CHAPTER ONE
INTRODUCTION

1.1 CHAPTER INTRODUCTION

This chapter introduces the context of this study with expectations to give a clear and complete understanding of the current phenomenon that has necessitated this research and how the study intends to address the problem. The chapter is structured as follows:

- Background to the study
- Problem statement
- Research aim and objectives
- Scope and limitation of the study
- Overview of the Research methodology outline
- Contribution of the research to the body of knowledge
- Overview of the thesis outline
- Chapter Summary

1.2 BACKGROUND TO THE STUDY

Housing is at the centre for many socio-economic activities and an element for measuring human development and urban growth (Wapwera, et al., 2011; UN- Habitat, 2011a). The need for continuous housing provision in any society is to ensure that adequate shelter is accessible to an ever-increasing population and enhance healthy and productive living amongst others. (Anyanwu, 1997). It is for this reason that many governments across the globe are unrelenting in their efforts to ensure adequate housing provision for the populace and particularly to those who without certain interventions cannot access adequate housing. However, access to adequate housing is a current and growing problem across the globe. In many cases, the cost of adequate housing is too expensive because incomes are relatively low and housing supply are limited (UN- Habitat, 2011a). As a means to address the problem challenging adequate housing particularly for the low and middle-income groups, successive governments across the globe have developed various strategies to need housing needs in their countries.

Low-cost housing (LcH) has evolved in many countries as one of the intervention strategies adopted by many governments to address the issue of housing needs, particularly for low and middle-income earners (World Bank, 1975; Assaf, et al., 2010). However, the concept of income group classification has no universal definition, as meanings may differ between countries reflecting differing national economies (Oladapo, 2001; Ogbu &Adindu, 2012). LcH in many countries is considered a non- profit driven venture but a social service for meeting the shelter needs of the low and middle-income population (Jingchun, 2011; Bakhtyar, 2013). In many developed countries such as the US, Canada, UK, Germany, Japan and France, LcH though government initiated is supplied through housing associations (Harris & Mathews, 2009: Doling & Ronald, 2010). Whereas in many developing countries such as China, Malaysia, and Nigeria, the government is directly involved in LcH provision through their housing agencies (Jingchun, 2011; Obi et al., 2015). This trend in developing countries is traceable to the level of housing deficits requiring direct government influence in both funding and development to stimulate drastic LcH supply.

The need for adequate LcH provision is one objective found in housing policies across the globe and particularly in many countries (Assaf, et al., 2010; McNelis, 2014). Scholars in housing literature such as Turner (1976), Pugh (2001), Choguill (2007) and Harris (2003) to mention a few have since early years established that adequate LcH provision has been a directive in housing policy adopted by successive governments particularly in developing countries. Consequently, reports (World Bank and UN-Habitat) have shown that emphasis on such policy directive in developing countries emerges from prevailing housing shortage which predominantly affects a vast majority of low and middle-income groups (Nenova, 2010; UN- Habitat 2011a). Various intervention strategies such as direct government production, self-help housing, and the whole housing sector development have been promulgated and implemented to facilitate LcH provision (Pugh, 2001, Choguill, 2007; UN-Habitat, 2011a, 2011b). However, several factors have challenged the success of these strategies for LcH provision in developing countries.

A body of documented literature (Barlow & Duncan, 1992: Assaf, et al., 2010; Sivam, et al., 2001; Kalu, et al., 2014; Gopalan & Venkataraman, 2015) identifies various challenges affecting LcH provision in developed and developing countries. Such problems include inadequate access to finance, unavailability and the high cost of land, lack of and inappropriate frameworks, poor project cost performances, ineffective policies and poor infrastructure to list a few. Consequently, studies by Gopalan and Venkataraman (2015), Kalu et al. (2014), and Assaf et al. (2010) in India, Nigeria, and UAE respectively have highlighted poor project cost performances as a driving factor contributing to the high cost of LcH. This high cost has further undermined the affordability of projected target beneficiaries. They further recommended that improving LcH project cost performances will facilitate successful LcH provision. Their recommendation suggests an existing relationship between effective cost performances and successful LcH provision, given that the final project cost impacts on LcH unit price and affordability addressing the issue of poor cost performance are perceived one of the viable avenues to achieve successful LcH provision particularly in developing countries such as Nigeria.

Poor project cost performance occurs when the final cost exceeds the initial budget and is expressed as the percentage cost overrun on client initial project budgets (Arcila, 2012). This problem is said to have become a norm in many construction industries across the globe, although its magnitude vary from one country to another. Studies (Flyvbjerg, et al., 2002, Arcila, 2012; Terrill, et al., 2016) in the developed countries of Australia and the United Kingdom show that this issue affects construction project delivery and can account for up to 25- 40 percent cost overruns. Similar studies (Ameh, et al., 2010; Odediran, et al., 2012; Chigara, et al., 2013; Memon, et al. 2014) in Nigeria, Zimbabwe and Malaysia, show that poor cost performances can range from 50 -100 and sometimes exceeding 100 percent cost overrun. This issue will appear to be more severe in developing countries. However, there are many factors associated with the economic, political and construction environments which can apparently influence the level of variation from one context to another.

As pointed out by Mbachu and Nkado (2004) and Odediran et al., (2012), poor project cost performances negatively affects the client, end-user and project team. For the client, he may be forced to abandon the project due to cost overruns, while for the contractors and consultants inability to deliver value for the money to the client, and the end user undermined affordability. This issue is apparently an endemic on LcH projects as in any other construction project in both developed and developing countries. The effect of this problem is even more severe in LcH project delivery owing to the need to produces as many houses as possible because of its enormous demand by a vast majority of the low and middle-income population in many countries. Hence, the need for effective mitigation measures to address this problem.

Some factors driving poor cost performances are identified in the literature. These include: design changes, variation orders, unstable market trends, poor financial/cost forecasting, poor cost planning and estimating systems and poor contract/site management to mention a few (Enshassi, et al., 2009; Olawale & Sun, 2010; Durdyev et al., 2012; Ubani, et al., 2013; Memon et al., 2014). However, several strategies associated with technology, procurement, management and policy approaches have been identified to help address the issue of poor cost performances, however, employing effective project cost management is proffered as a salient mitigating measure (Arif & Egbu, 2010; Ganja & Jacomit, 2011; Smith, 2014). Therefore, identifying effective cost management strategies are consequential to improving cost performances in the context of LcH project delivery in Nigeria. Many of these factors are found to be cost management related.

Project cost management is described as a process aimed to deliver effective cost performances through strategies and techniques that generate information to support early and effective decision making, stimulate cost reductions and provide value to the client (Tang, 2005; Azis, et al., 2012). However, to achieve effective cost management appropriate CMS is required. A CMS as described by Kern and Formoso (2004) is a structure comprising a set of techniques and processes required to set, plan, estimate, budget, control, and report project costs. An effective CMS, therefore, is a system that can ensure that the project is completed within the approved budget.

Several scholars such as Kern and Formoso (2006), Granja and Jacomit, (2011), Do et al. (2014) and Obi and Arif (2015) have emphasised the importance of effective CMS on project cost performances. Findings from their studies show that the efficacy of the CMS largely determines the potential outcome of project cost management and performances, hence, indicates that the CMS can be influential. Consequently, Kern and Formoso (2006), Granja and Jacomit, (2011), have developed and proposed CMS models applicable to LcH project delivery in Brazil for improved cost performances. However, studies (Iroegbu et al., 2010; Chigara, et al., 2013; Obi & Arif, 2015) have shown that the strategies for project cost management employed on many housing projects in developing countries in Africa such as Ghana, Zimbabwe, and Nigeria lack the capacity to drive effective cost performances. Nevertheless, it cannot be denied that their project management teams (PMT) comprising the housing agency supervision team, consultancy and contracting teams involved in LcH project delivery in these developing countries are unrelenting in their efforts to seek appropriate systems. The PMT in Nigeria is not an exception when the trend of poor cost performances particularly in LcH project delivery has triggered the close attention of public sector clients.

Nigeria is described as the most populous developing country in Africa and 7th most populated nation in the world. It is ranked the largest economy in Africa and 20th largest in the world with Gross Domestic Product (GDP) $568.51 billion (Isa et al., 2013; Okonjo-Iweala, et al., 2014). The country is said to be experiencing difficulty coping with the challenges of housing crisis already being experienced due to the poverty level, economic uncertainties, the poor performance of its construction and housing sector to mention a few (Allu & Ebohon, 2014; Isa et al., 2013; Okonjo-Iweala et al., 2014). The Federal Ministry of Lands, Housing and Urban Development (FMLHUD), (2012), estimates the housing deficit in the country at 17 million units. This amount suggests a potential high endemic of slums and makeshift accommodations in the nearest future if necessary actions to improve housing project delivery are ignored. One of the main challenges to address is the issue of poor cost performances affecting many housing projects and especially LcH projects in the Nigerian construction housing sector.

LcH is a popular demand by a vast majority of the low and lower-middle income groups constituting up to 80 percent of the Nigerian population (Federal Ministry of Lands, Housing and Urban Development (FMLHUD), 2012). Their dependence on LcH given their income levels is owing to its affordability when compared with the costs of similar houses in the open market. Apparently, many are opportune to gain access to adequate housing through LcH provision (Ayedun & Oluwatobi, 2011; Okpoechi, 2014) hence the pressure on its demand and need for its sufficient supply across the country. A study conducted by Onibokun (1990 cited in Adedeji & Olotuah, 2012) presented in Table 1.1 reveals that the low and middle-income group will require up to 73 percent of future housing supply in the country. Therefore, because of the huge demand, adopting appropriate and viable strategies cannot be overemphasised in the quest to improve production as much as possible.

Table 1. 1 Estimated housing needs of the Nigeria population

Income group	1990	2000	2020	2020 (Percentage)
Low	8,413,980	14,372,293	39,989,286	39.17
Middle	7,770,005	13,273,291	33,575,900	32.88
High	7,624,230	12,419068	28,548,633	27.95
Total	23,808,215	40,064,652	102113819	100

Source: adapted from Onibokun (1990 cited inAdedeji & Olotuah, 2012)

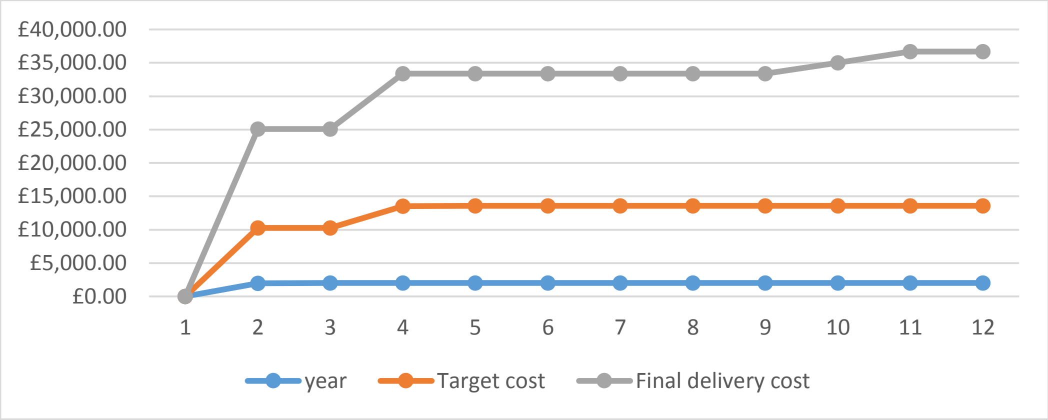
LcH projects are multiple residential housing developments with standardised design and construction in the same or several geographical locations, implemented under same project scheme and management and contract (Adinyira, et al., 2012). Akin to findings on LcH project delivery in other developing countries, LcH project implementation in Nigeria also face several challenges. Poor project cost and time performances, fluctuation in material and labour costs, uncertain economic and political environment, corruption and high transaction costs to mention a some of the factors challenging LcH project delivery in Nigeria (Akinde, 2012; Amade, et al., 2015). With other factors, holding constant, poor cost performance can be considered as one of the salient issues affecting LcH project delivery in Nigeria (Balogun, 2005; Akinde, 2012). A report by Akinde (2012) on LcH project performances as shown in Table 1.2 demonstrate that the projects all experienced cost overruns following the difference between initial and final costs that invariably affected the supply quantities and sale costs.

Table 1. 2: Trajectory of LcH project cost performances in Nigeria

LcH Schemes	**Number of Proposed Units**	**Proposed cost per unit (N)**	**Number of units supplied**	**Final cost per unit (N)**	**Percentage supplied (%)**
1st NDRP 1961 -1970	61,000	25,000	500	31,000	0.82%
2nd NDRP 1971-1975	120,000	73,000	7,080	89,500	5.9%
3rd NDRP 1976- 1980	202,000	78,000	28,500	110,000	14.10%
NHP 1986-1999	121,000	1,579,00	1014	≈ 2,867,000	0.84%
NHP 1999- 2007	148,000	2,500,000	8585	≈ 4,500,000	5.8%
NHP 2010- 2012	700,000	3,500,000	43,126	≈ 6,000,000	6.16%

Source: Adapted from FMLHUD (2012) and Akinde (2012)

Figure 1.1 illustrates a graphical representation of the cost performance per housing unit from a period of 2001- 2012. From the graph, the average initial project costs are below £15,000.00, while the final project costs were between £25,000.00 and £36,000.00. Evaluating the cost difference show an average of 53.5 percent cost overrun indicating poor cost performances.



Note: £1= ₦252.00 at April, 2015 exchange rate.

Figure 1. 1: Low-cost housing project cost performance in Nigeria

Source: Adapted from FMLHUD (2012) and Akinde (2012)

Production cost and affordability of target beneficiaries are key considerations in LcH project delivery (McNelis, 2014). From the graph, whiles initial costs have remained almost constant from 2004 -2012 (4th -12th) year, which shows that the project cost allocations are rigid for each NDRP period (FMLHUD, 2012). Economic factors such as inflation are also inbuilt into the cost. This show that government on their part have strict budgets for these projects which the PMT are expected to take into consideration using effective project management approaches. However, studies show that time delay, fluctuations in material and labour prices, poor cost management systems, variations, construction waste and corruption to mention a few are many of the problems that led to costs overruns on these projects in these years (Akinde, 2012; Amade, et al., 2015). Since cost allocation projected for each LcH scheme in a period is almost at a constant, effective approaches for cost optimisation in LcH project delivery need to be adopted, to prevent the occurrence of poor cost performances. Such measures to address the issue of poor project cost performances is a viable means of improving LcH supply-side outcomes (Okonjo-Iweala, 2014; Gu et al., 2015). Following a recommendation by Ahiaga-Dagbui et al. (2015), a system thinking approach is necessary in a bid to address poor project cost performances whereby systematic solutions are employed to mitigate the factors facilitating poor cost performances. Since existing studies show, a relationship between project cost management and performances, adopting an effective and appropriate CMS can be considered a systematic solution to addressing the problem poor project cost performances in LcH project delivery in Nigeria.

1.3 PROBLEM STATEMENT

Low performance in housing provision is one of the problems facing the country. Poor cost performances in LcH project delivery in Nigeria is said to affect LcH supply adversely, in terms of unit output, high sale prices, undermined affordability of expected target beneficiaries and poor housing situations (Ogu, 1996; Mabogunje, 2007; Okoroafor, 2007; Akinde, 2012; Ogbu & Adindu, 2012). These effects have resulted in many of the Low and lower-middle income groups seeking shelter in slums and other sub-standard houses (Nubi, 2008; FMLHUD, 2012; Makinde, 2014). There is sufficient evidence showing that many states in the country lack adequate housing resulting in number of rising slums and other makeshift accommodations (UN-Habitat, 2011a). A typical example is the southeast zone characterized by makeshift accommodations (Ukiwo & Chukwuma, 2012; Duru & Anyanwu, 2014; Nkwede, 2014) as shown in Figure 1.2. Apparently, available statistics from the National Bureau of Statistics in Nigeria (NBS) (2015) and Ebie (2010), show that the southeast zone has a derivation estimation of up to 2 million housing deficits. One of the reasons for such deficits is the unsuccessful delivery of many LcH projects in the zone and in Nigeria (Ozurumba, 2011; Ogbu & Adindu, 2012; Ugonabo & Emoh, 2013).

Figure 1. 2: Housing conditions in the Nigerian Southeast zone

The inherent challenges affecting the LcH sector have in no doubt given way to the appalling state of housing crisis both in the zone and across the country (Ugonabo & Emoh, 2013). One of the identified problems is the issue of poor project cost performances which is endemic in LcH project delivery in Nigeria. Studies by Okoye et al. (2014), Obi and Arif (2015) highlights poor cost management as one of the main facilitators of poor cost performances experienced on housing project delivery in Nigeria. In their view, improving strategies for project cost management is pivotal to improving project cost performances.

Given the espoused relationship between project cost management and CMS, from previous studies (Kern & Formoso, 2006; Granja & Jacomit, 2011; Do et al., 2014) employing effective CMS can be one of the viable avenues to overcome the challenge of poor cost performances in LcH project delivery in Nigeria. However, in spite of the vast attention dedicated to the problem of poor cost performances, the Project Management Team (PMT), apparently still lack the appropriate strategies for effective project cost management on these projects (Ubani, et al., 2013). Furthermore, there has been limited evidence to support the claim that the PMT possess appropriate CMS given the occurrences of poor cost performances in LcH project delivery in Nigeria. It is for this reason that the following justifications for this study have come to the fore.

1.3.1 Justification for the Study

The peculiar characteristics of LcH project delivery in terms production cost and affordability (McNelis, 2014) indicate that resource constraints are more rigid in LcH projects than in another type of projects. The emphasis on LcH project is more on delivery and not just on costs, at such, cost considerations taking seriously on other project types are often taken for granted by all the stakeholders. Furthermore, the fixed budget allocated to the project often undermine practical considerations in cost management. Nevertheless, there are tremendous opportunities that can be used to drive down cost in LcH to make it affordable employing appropriate CMS that emphasises collaborative dynamics, particularly from the pre-design stage. This edge is what a well-developed CMS model can provide to PMT to facilitate further cost reduction in LcH project delivery and double output without compromising quality applying an effective systematic approach to cost management.

Secondly, there is a good amount of research in the field of project cost management and public sector housing projects. However, the majority of these studies are not, particularly in the Nigerian context. Findings from a search in project cost management related publications from three well-referenced databases using keywords on housing, low-cost, housing, project, cost performance, cost management, Nigeria, from Jan 2004- June 2015 in electronic databases, (Table 1.3), show extensive descriptive investigations. From the Table 1.3, a plethora of studies has attempted to identify factors affecting project cost management and poor cost performances such as ineffective CMS (Ogwueleka, 2011; Amade, et al., 2015) without exploring the reasons why such factors emanate.

Table 1. 3: Publications on Cost management in Low-cost Housing project delivery

Source	**Housing Nigeria**	**Construction project Cost performance, Nigeria**	**Construction project Cost management, Nigeria**	**Cost, project Housing, management, performance Nigeria**
A	14	14	4	1
B	6	11	3	0
C	24	16	4	2
Total	44	41	11	3

Source: A= Emerald Management B= Science Direct and C= Google scholar databases.

Similarly, some other studies have succeeded to highlight the common techniques employed in CMS (Sanni & Duruola, 2012) without further investigation on the relationship between the techniques and the effective performance of the CMS. Furthermore, none of these has attempted to proffer implementation models or frameworks that can improve the efficacy of CMS employed in LcH project delivery towards improved cost performances. Though the findings from the above studies are all relevant, they are considered inconclusive to improve CMS outcomes on LcH project delivery holistically. Furthermore, Findings from the studies examined also show another problem, which is the vast scope of analysis, which lumps together the influences of stakeholders, time, quality, management strategies, and technology. This research intends to focus on CMS to identify specific factors that can improve project cost management for LcH project delivery in Nigeria for effective implementation.

Similarly, a search across publications by the Nigerian Institute of Quantity Surveyors, a known body responsible for cost management practice in Nigeria did not reveal contemporary CMS models applicable to LcH project delivery. More often than not, the project PMT seems to rely on assumptions, experience, and intuitive judgment for project cost management that cannot be adequately described as a structural or implementation system model.

These findings indicate that in spite of the enormous attention on poor cost performances and project cost management, there is currently no clear evidence in the literature on frameworks or models for CMS implementation in the context of LcH project delivery in Nigeria. The paucity of such models to guide effective CMS implementation in LcH project delivery could be one of the many reasons challenging the effective cost performance outcomes. Therefore, considering the espoused relationship between CMS and project cost performances, it is the researcher's view that rather than seeking "survival strategies" for project cost management (Ubani, et al., 2013), the avenues to improve the efficacy of current CMS should be explored.

Consequently, developing an appropriate CMS applicable and implementable by the PMT for improved cost management and performances in LcH project delivery will require contextual investigations. Since the issue of poor cost performances is endemic on LcH project delivery across the country, an examination of a typical case such as the Nigerian southeast zone will be most appropriate. The selection of the Southeast zone is hugely on the premise of the zone's position as a flagship (pilot) for government intervention in the LCH provision. Policies, systems and technologies innovations employed for delivery of LcH projects in the zone has been generalised across the country. Hence, it is expected innovations for LcH project delivery in the zone are easily generalisable across the country. The individual and collective knowledge and experience of the PMT involved in LcH project delivery in the southeast zone will be gathered and structured to facilitate the development of a well-structured system model for LcH project delivery. Such investigation and output are what this research seeks to proffer. Such proffered solutions are a good stead for the successful realisation of the LcH schemes both in the southeast zone and Nigeria in the nearest and far future.

Finally, there is the need for appropriate management models for LcH project delivery. Proffering an appropriate CMS model will be beneficial to the PMT and the housing agency in project cost evaluation and standardisation procedure guide. The integration of this CMS model to existing models for project time and quality management can be used to develop a holistic framework to assist housing agencies in successful LcH project delivery in both the southeast zone and Nigeria at large.

Given the above justifications, there are specific questions that need to be answered in this research context.

1.4 RESEARCH QUESTIONS

- What is currently known about LcH project delivery in developing countries such as Nigeria?
- What current project cost management system (s) is employed for LcH project delivery in Nigeria and especially the southeast zone?
- Why is the current cost management system(s) employed unable to deliver effective cost performances in LcH project delivery in Nigeria and especially the southeast zone?
- How can the current cost management system(s) be improved to facilitate effective cost management and performances in LcH project delivery in Nigeria and especially the southeast zone?

1.5 RESEARCH AIM AND OBJECTIVES

This section details the purpose of this study and the sequential steps to achieving the aim.

1.5.1 Aim

To develop a cost management system model (CMSM) for LcH project delivery in Nigeria

1.5.2 Objectives

- Critically review the concepts and characteristics of LcH project delivery, project cost management systems (CMS) and implementation success factors (IMSF).
- Identify the characteristics of the cost management system(s) employed in LcH project delivery in Nigeria.
- Evaluate the efficacy of the current project cost management system(s) employed on cost performances of LcH projects in Nigeria.

- Identity the most suitable techniques, process approach, and key implementation success factors that can potentially improve the efficacy of the CMS for the LcH project delivery in Nigeria.
- Conceptualise and validate a system model for improved cost management and performances in LcH project delivery in Nigeria.

1.5.3 Relationship between Research Objectives and Questions

Table 1.4 below shows the relationship between the documented research objectives and questions.

Table 1. 4: Relationships between research objectives and questions

Research Question	Research Objective
What is currently known about LcH project delivery in developing countries such as Nigeria	Critically review the concepts and characteristics of the LcH project delivery and project cost management system and implementation success factors.
What current project cost management system (s) is employed in LcH project delivery in Nigeria and especially the southeast zone?	Identify the characteristics of the cost management system(s) employed for LcH project delivery in the Nigeria.
Why is the current cost management system (s) employed unable to deliver effective cost performances in LcH project delivery in Nigeria especially the southeast zone?	Evaluate the efficacy of current project cost management system(s) on LcH project cost performances in Nigeria.
How can the current cost management system(s) be improved to facilitate effective cost management and performances in LcH project delivery in Nigeria especially the southeast zone?	Identify the most suitable techniques, process approach and key implementation success factors that can potentially improve the efficacy of CMS for LcH project delivery in Nigeria.
	Conceptualise and validate a system model for improved cost management and performances in LcH project delivery in Nigeria

Source: Compiled by Researcher

1.6 SCOPE AND EXCLUSIONS OF THE RESEARCH

LcH project delivery is a critical phase in housing provision, and project cost performance is said to primarily affect quantity supplied, market prices, and affordability (Okoroafor, 2007; Massyn, et al., 2015). Evidence reveal that an effective CMS is pivotal to improve cost performances (Kern & Formoso, 2006; Granja & Jacomit, 2011). Hence, the present study seeks to improve LcH project cost performances by examining the CMS employed. This current study confines itself to investigating the CMS to understand why current CMS employed on LcH projects are unable to deliver expected project cost performances. This investigation is a view of determining and proffering appropriately structured improvement in the CMS given its influence on LcH project cost performance. The study on CMS in this context covers the cost management techniques, process, implementation success factors, and their interactions within the system to facilitate effective outcomes. Furthermore, the evaluation of the CMS reflects its application only to the predesign, design, and construction stages were cost optimisation can be effectively maximised.

The study scope excludes the management of the other types of costs such as land, finance and maintenance costs as these costs are associated with the other phases of LcH provision. Time, quality, stakeholder management, procurement system, etc. that can affect project cost management, and performances are assumed constant therefore excluded from this study investigations. Furthermore, extensive studies have been conducted in these areas in the past without much focus on CMS in project delivery. In addition, the study excludes comparative investigations on the CMS from the global perspective with the study context and does not intend to transfer of CMS models to the study context however, examines the best practices across towards developing an appropriate and effective CMS model. These exclusions are necessary as it is the research view that it will be an unrealistic attempt to investigate all these encompassing features associated with the LcH project delivery in one study.

Apparently, LcH project delivery in Nigeria has no significant difference regarding design, construction, policy, management and delivery system across the zones in the county. Since poor cost performances in LcH project delivery is a common issue facing the housing sector across the six geo-political zones in Nigeria, this research situates its empirical investigations in the Nigerian southeast zone. The selection of this geographical scope is owing to its position as a historical flagship model zone for the LcH scheme in Nigeria (FMLHUD, 2012). Other reasons are the prevailing housing situation, endemic of poor cost performances in LcH project delivery and access to in-depth qualitative investigations in the zone (Akinde, 2012; Odediran et al., 2012; Ubani, et al., 2013). More justification for this selection is detailed in section 1.3.1 and 3.5.2.

Since the Nigerian government has proposed massive LcH project constructions across the country and including the southeast zone consequent to prevailing housing crisis (FMHLUD, 2012; Gemade, 2012) investigation towards a well-developed CMS model for LcH project delivery will involve:

- An examination of CMS for LcH project delivery in the southeast zone to aid contextual understanding and offer a more robust and detailed case analysis.
- The detailed case analysis will yield optimal data on the characteristics of CMS and LcH project delivery
- Findings from the detailed case study will lead to the development of an appropriate and suitable CMS model that can be widely adopted by PMT to improve their cost management and performances in LcH project delivery in both the southeast zone and Nigeria.
- The findings from the detailed case analysis of CMS for LcH project delivery in the southeast zone can be generalised to other zones in the country. Hence, create a platform for developing best practice frameworks for cost management of LcH project delivery in Nigeria.

1.7. OVERVIEW OF RESEARCH METHODOLOGY

Research methodology is a way of describing how a researcher goes about the task of conducting research. The research leans towards interpretivism and adopts a single embedded case study design. This strategy allowed the researcher to explore in-depth and gain an understanding of the detailed representation of the CMS employed in LcH project delivery. The CMS for LcH project delivery is selected as the unit of analysis. Information on the CMS helps to evaluate the contextual interactions between the inputs and process variables within the system and its effects on project cost management and performances.

A sequential mixed methods procedure allowed the researcher collect, analyse, and interpret data at various phases of the research process. A mix of semi-structured interviews, focus group interviews and questionnaires facilitated in-depth contextual information from PMT on relevant issues concerning the CMS at various stages of the research process. The qualitative data collected was analysed using thematic-content analysis aided by the NVIVO software application package, while the quantitative data collected via questionnaire surveys was analysed using descriptive and inferential statistics with the help of SPSS application package. The process model, ISM, and IRP techniques aided the CMSM design and development. These modelling techniques particularly ISM and IRP are innovative contributions in the field of project cost management. The CMSM validation facilitated refinements where necessary and allowed for its proposal to PMT for adoption. This contribution leads to the development of a theory on CMS for LcH project delivery in Nigeria. A summary of the research process framework is depicted in Figure 1.3. The process has three stages. The first stage explores the need and aim of the study as well as reviews related concepts of LcH project delivery, project cost performance, CMS, and IMSF. Stage two focuses on identifying the variables and relationships of the components of the CMS to be modelled through the findings of the data collected and analysed. Stage three organises the results from the second stage in a coherent manner using three modelling techniques to design and develop the CMSM consequently validated.

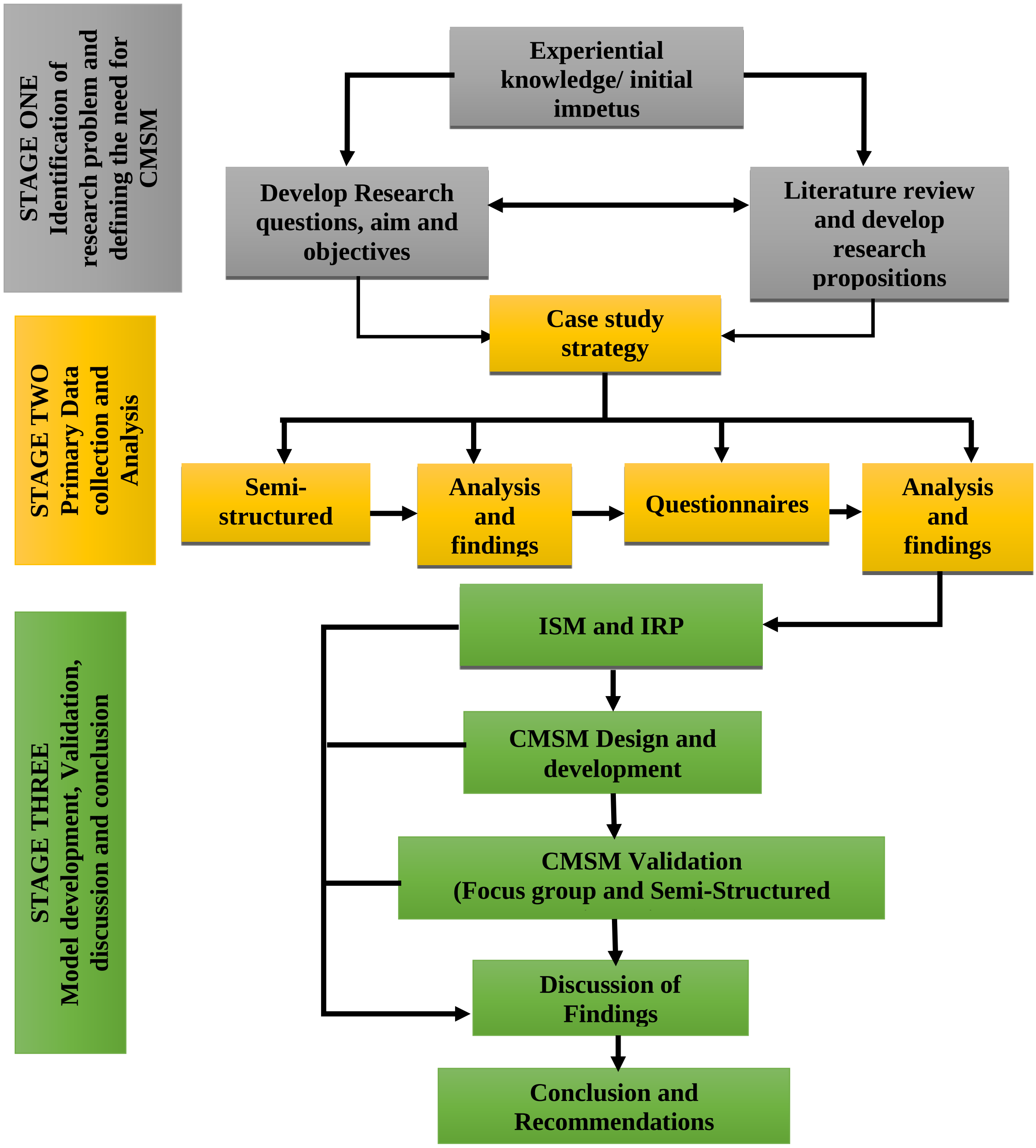


Figure 1. 3: Research process Framework

1.8 CONTRIBUTIONS OF THE RESEARCH

Improving effective project cost performances is a well-voiced viable strategy to stimulate successful LcH delivery particularly in developing countries like Nigeria (Smith, 2014; Oladapo, 2001). Apparently, several studies have pointed to the fact that effective project cost performances are unachievable without effective cost management with the latter largely dependent on the project cost management system implemented. Therefore, employing appropriate systems that can enhance effective cost management will be of great benefit to the PMT in achieving effective cost performances. However, judging by empirical studies, there have been limited studies with no clear attempts to develop or proffer an appropriate CMS for LcH project delivery in the Nigerian context to the best of the knowledge of the researcher. Therefore, this study has both academic and practical contributions.

To the academic body, findings from the research contribute to the body of knowledge in expanded literature on Low-cost Housing, LcH project delivery, project cost management techniques and processes, and implementation success factors. Furthermore, the documented research methodological process illustrates the application of a mixed method in single embedded case study design. These contributions will provide a platform that future researchers conducting empirical investigations on cost management within housing research in developing countries can adopt. Besides, the modern techniques such as target costing, target value design and Earn value analysis highlighted in this study are areas for curriculum improvement in teaching mainly for quantity surveying students in higher institutions of learning in Nigeria. Such development will equip the students with the knowledge required for contemporary cost management practice.

The proposed CMSM clearly highlights the techniques, process approach and key implementation success factors to guide the PMT in effective project cost management. Therefore, it is expected that CMSM is used by the PMT to set, plan, budget, monitor, and control project costs to actualise project cost objectives and improve the cost management practice in LcH project delivery in both the southeast zone and Nigeria.

1.9 THESIS OUTLINE

This report is comprised of eight chapters, as illustrated in Figure 1.4 and the contents of each chapter are presented as follows:

- ***Chapter 1*** gives an overview of the research context stating rationale and questions to be answered in the research. It further defines the aim and objectives and provides an overview on the choice of methodology. It defines the research scope and highlights the contribution of the research to academia and practice. Finally, it presents the structure of the thesis and research framework.

- ***Chapter 2*** presents a narrative and systematic review of literature starting from a global perspective of developed and developing countries to the Nigeria context on the three core concepts of the research. These concepts are LcH provision and project delivery, CMS and Implementation Success Factors.
- ***Chapter 3*** presents the research methodology starting with the overview of the type of research, research philosophy, research strategies and methods describing the justification for the choice adoption in this research.
- ***Chapter 4*** presents the analysis of the results from data collected via the semi-structured interviews. The characteristics of current CMS practice, the relationship between CMS and poor cost performances, technical and implementation constraints are covered in this chapter. The chapter also reports possible measures (technical and implementation) to improve the popular CMS. It summarises emerging themes for further explanation and validation.
- ***Chapter 5*** presents the analysis of the results from data collected from respondents via the questionnaires on CMS characteristics; the relationship between CMS and LcH project cost performances including factors and associated drivers for successful CMS implementation. The findings validate reports on possible techniques and IMSF to improve the CMS in current use. The information confirmed the specific components needed for the development of the CMSM.
- ***Chapter 6*** presents the design conceptualisation and development, of the Cost Management System model (CMSM). It shows the use of process model, interpretive structural modelling (ISM) and interpretive ranking model (IRP) techniques in the structural design of the key components of the CMS model. It also discusses the CMSM validation results based on input from experts using focus group and semi-structured interviews.
- ***Chapter 7*** presents a discussion of the findings that emerged from the results of the analysed questionnaires, semi-structured interviews and literature to illuminate their importance on the research aim and objectives.
- ***Chapter 8*** presents the research conclusions, recommendations specific contributions to the knowledge relevant to academia, practice and future research. It further documents limitations and suggested areas for possible further research.

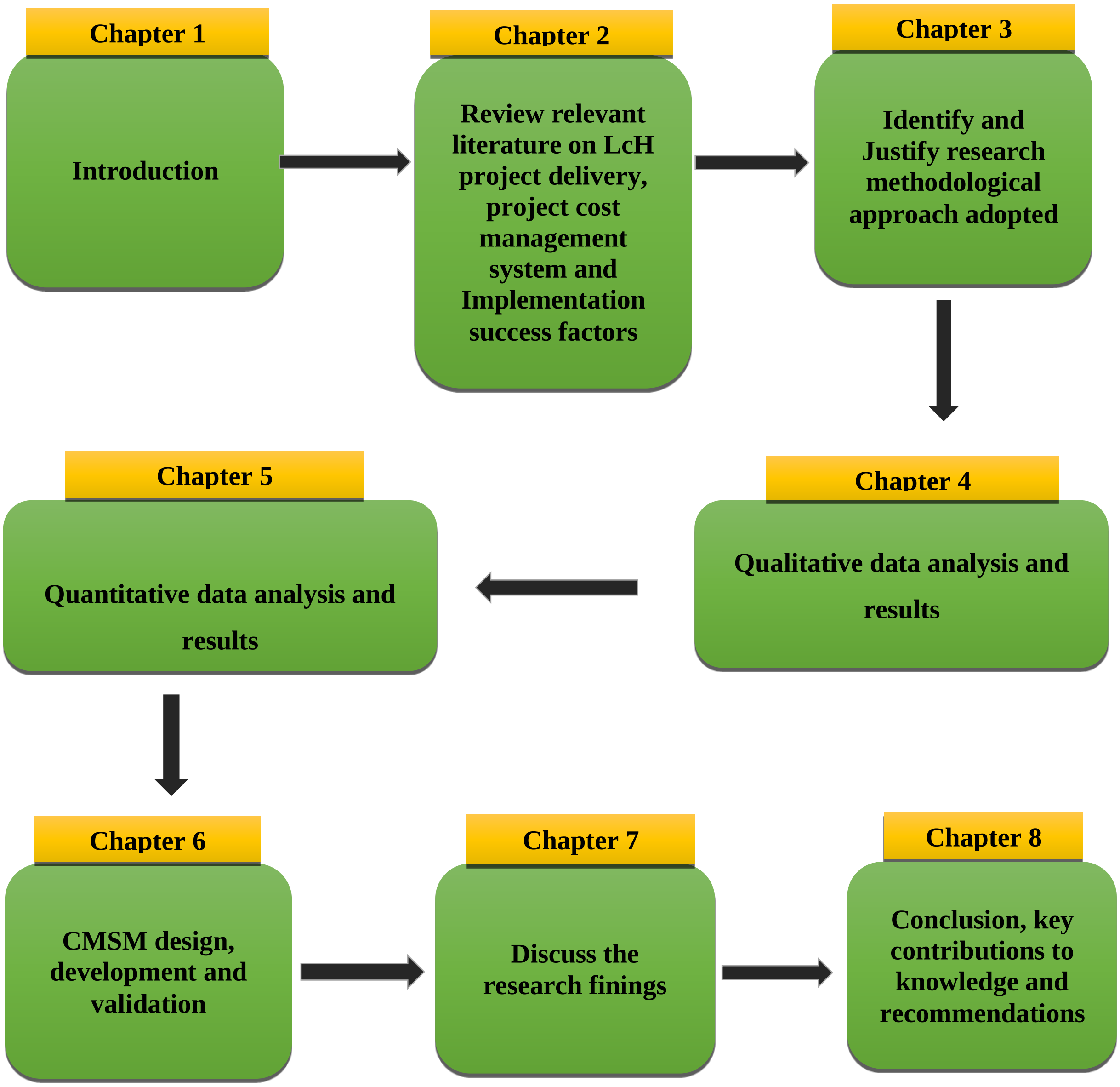


Figure 1. 4: Research outline

1.10 CHAPTER SUMMARY AND LINK

This chapter has provided an overview of the issues that have necessitated this research, and reflects in the background information, problem statement, and justification. The research intends to achieve the intent expressed in the study aim followed by a set of proposed objectives showing the relationship between the set objectives and the research questions. This chapter documents a proper description of the boundaries of the study followed by a highlight of the study's relevance and contribution to the body of knowledge. Furthermore, the choice of research methodology adopted is highlighted and concludes with an insight into the remaining part of this thesis. The next chapter moves forward into a conceptual review of extant literature in the related areas of LcH project delivery and project cost management system in both general and specific contexts of Nigeria.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter critically reviews and evaluate the thoughts and experiences of past studies on the key concepts of this research. This review is necessary to facilitate a theoretical understanding of the development of the conceptual model. Starting with a basic understanding of the concepts of LcH provision generally and within the Nigerian context, this section proceeds to discuss LcH project delivery and project cost performance, CMS, and implementation success factors (while presenting the precise relationship between techniques, process and success factors for effective implementation). This chapter is structured into the following sub-headings:

- Concept of Housing Provision
- Concept of Low-cost Housing Provision
- Low-cost Housing Provision in Nigeria
- Project Delivery- a Low-cost Housing Perspective
- Project Cost Management System
- Implementation Success Factors
- Cost Management Models for Low-cost Housing project delivery

2.2 CONCEPT OF HOUSING PROVISION

This section discusses the concept of housing provision with a focus on its need, providers, and process. For a clear understanding, this section starts by defining the term housing as used in this context.

2.2.1 Housing

Housing is one of the universally accepted fundamental human need and an indicator to determine the quality of life and welfare of people and places (Un- Habitat, 2011; FMHLUD, 2012; UN- Habitat, 2012). It is said to constitute the largest single land use in many developed countries and can accounts for up to 30-35 per cent of construction expenditures in an average year in many countries (Conway, 2003; Lund, 2006). Technically, housing is a stock dwelling, a collection of residential buildings, houses, or units where people live. These dwellings can be single family homes or multi-unit townhouses and apartments which could be in the form of detached, semi- detached, high or low-rise (Barrie & Paulson, 1992). Hence, a non-standardized product because of the different preferences required by its dwellers as regards to size, quality, taste, location, and tenure system (Ball, 2013). These definitions bring to light that housing is a basic product needed to satisfy economic, social, political and cultural necessities of people and places.

Furthermore, the term housing is also viewed as a process. A definition by Lundqvist (1992), describes it as a holistic process that includes the product (dwelling), its provision (process), and tenure. MacLennan (2012) and Akinde (2012) also defined housing as a process embodying a set of necessary actions that involves the process of planning, production, financing, allocation, and maintenance, synthesized for the product to reach a marketable with a habitable standard. This view of housing as used is an action involving a series of processes.

Housing is also described as an investment or consumption good drawing from two schools of thought (Kemeny, 1992 cited in Ilesanmi, 2010; Sheng & Mehta, 2008 cited in Jingchun, 2011; Miles, 2013). From an economic perspective, housing is an investment good. The economic development investment in housing can account for up to 15-35 percent of the aggregate investment. Hence, the need for housing is a panacea that enables accelerated economic development and a substantial contribution to the Gross Domestic Product in many countries (Nenova, 2010). On the other hand, housing as a consumption good contributes directly to human prosperity and indirectly to health and productivity, a major measure of both living standard and human development index (Taiwo & Adeboye, 2013). Its necessity is to significantly give direct human satisfaction to drive the productivity, and success of other human activities. (Sheng and Mehta, 2008 cited in Jingchun, 2011; UN-

Habitat, 2011a). It is, therefore, a consumption product that measures the worth of every individual.

Based on the above definitions the term housing can connote a structure for shelter purposes, a process for providing shelter or need to meet consumption and investment purposes. These views create various investigative perspectives. However, this study is more inclined to the use of the term housing to connote a structure for shelter to meet consumption purposes. Hence, housing is defined in this study as a collection of residential buildings, designed and constructed to meet the shelter need of a country's inhabitants.

2.2.2 Housing Provision

Housing consumes a well amount of time and is influenced by the demand and income capacity of the proposed dwellers Turner (1976) and Saunders and Williams (1988, cited in Huchzermeyer, 2001) which makes the subject of housing provision a critical issue to discuss.

Housing provision is defined as a process involving a series of interrelated stages to initiate, produce, supply, and maintain new and or existing housing (Agbola & Alabi, 2000; Hecht, 2006). It considers the context of supply and demand based on housing needs and requirements (Fordham et al., 1998; Jolaoso, et al., 2012). These terms are often used in housing literature and on many occasions are used interchangeably by various scholars. Therefore, an understanding of their definitions will help clarify their use in the following sections of this report.

- Housing Supply is the amount of dwelling units available in a housing market, region or country (Nenova, 2010; Carswell, 2012)
- Housing delivery is a continuous process of producing a dwelling unit, have this unit occupied by one or more households, and where necessary rehabilitate or renew the building to extend its lifespan (Onyeacholem, 1991).
- Housing Demand is the quantity of housing of the type and quality that households both want and can afford to buy or rent in the open market without subsidy. Thus, housing demand takes into account both preference and the ability to pay (Golland & Blake, 2004; Peak Sub Region Strategic Housing Market Assessment (PSRSHM) 2008).

- Housing Need: quantity of housing of the type and quality necessary to house those households currently lacking their housing or living in housing which is unsuitable or inadequate and who cannot afford to buy or rent suitable housing in the open market. (Golland & Blake, 2004; PSRSHM, 2008). Hence, need takes account of those without adequate housing who are unable to resolve their situation without assistance.
- Housing Requirement encompasses both housing demand and housing need and is, therefore, the quantity of housing necessary for all households to have access to suitable housing, irrespective of the ability to pay (Golland & Blake, 2004). Put simply; it is the amount of housing needed to accommodate the population at appropriate minimum standards as defined by the Government or local policies.

From the above definitions, it is clear that though all the terms appear similar, there are noticeable differences in their definitions. Whereas housing demand is associated with the capacity to afford, housing need refers affordability assisted through interventions. Similarly, housing delivery excludes policy initiation in its process and housing supply the number of the housing unit or stock in a given geographical location. However, housing provision is holistic comprising delivery, supply, and requirement. Therefore, to avoid ambiguity, these terms are not used interchangeably in this context.

2.2.3 Modes of Housing Provision

Housing provision modes are avenues through which dwelling units are initiated developed and supplied (Keivani & Werna, 2001; Golland & Blake, 2004; Harris & Mathews 2009). These modes of housing provision in developed countries are through government, housing associations and private developers because of a well-structured system (Golland & Blake, 2004; Harris & Mathews 2009; McNelis, 2014). However, in developing countries, the modes could be categorised under conventional and unconventional approaches as illustrated in Figure 2.1. The conventional approach embodies provision through formal and regularised organisations, such as government/public sector, private sector developers, and cooperatives. On the other hand, the informal approach relies on individual efforts in a non-structured developmental setting, thereby creating squatter or slum settlements in most cases (Keivani & Werna, 2001). This research situates in the paradigm of the conventional approach, and it is further discussed.

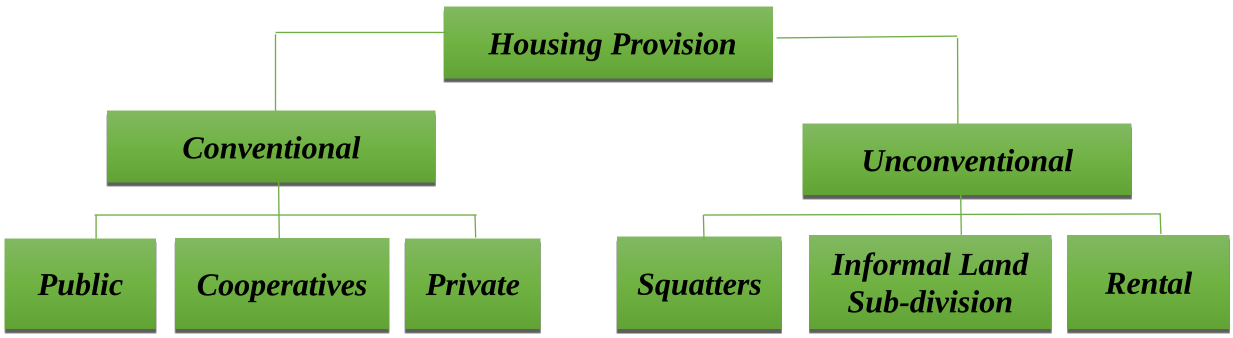


Figure 2. 1: Model of housing provision in developing countries

Source: Keivani and Werna (2001)

2.2.2.1 Housing provision through private sector

This mode of housing provision is individuals (owner-led), property developer, or through the cooperation between developer and house or landowners are initiators (Tsenkova & Witwer, 2011). Housing provision through this mode is mainly speculative though there are exceptions when provided by non-governmental organisations. Its product take many forms from individual to commercial house buildings and large-scale speculative residential developments. In many countries, this mode contributes a large quota to the overall housing provision varying from about 20 to 60 percent in many developed countries (Okpala, 1992; Keivani & Werna, 2001). For example, in a country like the United Kingdom (UK) the private sector largely contribute to the housing construction and management (Mullins & Murie, 2006). In many developing countries also, this mode primarily add to the housing stock however favouring mainly the middle and high-income groups (Keivani & Werna, 2001: Ndubueze, 2009). Hence a primary form of provision to meet housing demand.

2.2.2.2 Housing provision through joint venture

In this mode, housing provision is through a partnership between public authorities and private firms. The government provides proper land and tax incentives while the private firms finance the construction of the dwellings. The private enterprises go into this partnership in exchange for being able to sell an agreed part of the projects on the open market and offer the rest to a class of set beneficiaries at agreed prices (Keivani &Werna, 2001; Murillo, 2001; Madden, 2011). Both the public authorities and private firms jointly provide housing and this joint venture is more predominant in many developed countries such as the UK and the United States of America (USA). However, many developing countries are beginning to embrace this approach to housing provision. This strategy of provision is a means to meet housing requirement.

2.2.2.3 Housing provision through public sector

In this mode, government through designated housing agencies directly initiate, organise and manage housing development for the populace. (Keivani &Werna, 2001; Doherty, 2004). Government through their housing agencies provide shelter for the populace particularly the middle and the low-income groups either by direct construction of the housing units or through aided self-help and settlement upgrading programmes (UN-Habitat, 2011a). Overall, however the share of public housing provision in developing countries has only been around 10 percent of the total housing stock and in some cases accounts for about one in three dwellings provided (Okpala, 1992; UNCHS, 1996, cited in Keivani &Werna, 2001). In many developing countries in South Asia and Africa, such as like South Africa, Ghana and Nigeria, the housing provision through this mode have not recorded minimal success over the decades However, efforts to make positive strides to meet housing need particularly through the provision of LcH are constantly evolving.

2.3 CONCEPT OF LOW-COST HOUSING PROVISION

Governments in many countries pay close attention to alleviating the issues surrounding housing for the populace, particularly those within low and lower-middle incomes. A vast majority of this group apparently can afford to neither build for themselves nor make effective demand of available housing without any form of assistance (Fordham et al., 1998; Choguill, 2007; Un- Habitat 2011a; 2011b). Meeting the housing needs of these groups has engendered various intervention strategies, one of which is LcH provision. LcH evolved in many countries as an intervention strategy used by government to alleviate the housing needs of the portion of the population who without assistance cannot afford adequate housing at prevailing market rates (Davis, 1997; Assaf et al., 2010). LcH in some text is referred to as affordable housing, social housing, subsidized housing, low-income housing, public housing and low medium cost housing. Davis (1997) argued that these terms all represent synonyms generally denoting housing, for those who cannot afford free market prices. However, Disney (2007 p. 1) argues that the term affordable housing is vague because it includes: “Public”, “community”, “non-profit”, “social” and “high-need” housing which is a generic term… for housing managed by a government agency or non-profit organisation”. For better clarity, he proposed that affordable housing be defined under headings of government or private sector provision. This research accepts this recommendation as appropriate given that LcH is provided through the public sector mode (Section 2.2.3) which will facilitate a more refined and contextual definition for LcH. Therefore, it is important to define LcH as used in the context of this research before progressing to discuss its providers and provision process.

2.3.1 Definition of Low-cost Housing

LcH as defined in the World Bank report (1975) are dwelling units developed within minimum but adequate standard and specifications and affordable to the poor. This definition has since evolved with the UN- Habitat (2011a) report describing the houses as mass houses of adequate standard affordable to the low-income groups. However, the classification of a low-income group may differ in varying contexts considering differences in national economies (Oladapo, 2001; Ogbu & Adindu, 2012). The variance in economies indicates that the definition of LcH will be country specific.

In developed countries like United Kingdom, the term affordable housing connotes housing, developed at specified standard and quality and supplied at prices affordable to eligible groups whose needs are not met by the market (Golland & Blake, 2004; Harris & Matthews, 2009; United Kingdom Department for Communities and Local Government, 2013). These houses are provided mainly through the housing associations in joint venture with government. This practice is similar in the United States of America it is housing developed or provided at an affordable cost for households in the middle or lower end of the income scale. The occupant(s) are expected to pay not more than 30 percent of their income for gross housing costs including utilities (Hecht, 2006; United States Department of Housing and Urban Development (HUD), 2014). In Australia, LcH is affordable housing reasonably adequate in standard and location for low or middle-income earners and available at cost, which can be sustainable (Disney, 2007). Apparently, from the developed countries perspective, LcH are dwelling units developed to meet the housing need of people within low and lower-middle income group.

From a developing country perspective, Mostafa, et al., (2006) and Jingchun (2011) in a study in China defined LcH as legally restricted for the use of persons or households who meet specific income requirements, particularly the low-income group. Jingchun (2011) espoused that LcH provision is mainly through the public sector mode. He argues that LcH differs from commercial housing based on the following characteristics; the nature of the provider, the access of funding for the development, factors that determine value, specification and standards as well as the procedure for the sales. The difference in characteristics is summarised in Table 2.1.

Table 2. 1: Differences between Low-Cost Housing and private Housing

Variables	**Private housing**	**Low-cost Housing**
Developer	Real Estate Developer	Government
Project Fund	Private Fund	Housing Provident Fund
Construction style	High taste living level	Basic living level
Allocation mechanism	Market mechanism	Direct allocation

Source: Adapted from Jingchun (2011)

In Malaysia studies by Mulok and Kogid (2008) and Hamzah (2012) describes LcH as housing developed and provided to the low and low- medium income group. These houses are of minimum standard and quality with a minimum floor space 60- 63m2 not exceeding three bedrooms and provided at affordable cost to meet compelling housing need. These houses are either public or private sector provided.

Perspectives from developing countries in the African region are quite similar. Tonkin (2008 cited in Le Roux, 2011), defined LcH in South Africa, as housing units whose total housing costs are deemed affordable to a group of people within a specified income range, and includes social housing and low-income housing. While Onatu (2010) referred to such housing as affordable housing for low to moderate income earners. Studies by Arku, (2009) on housing in Ghana defines LcH as housing priced below the general market price and affordable to the low-income earners.

In Nigeria, the National Housing Policy (NHP) document FMLHUD (2012) refers to LcH as housing developed for sale at affordable prices to low and middle-income groups in the country. These houses are initiated funded, and constructed and managed by government through the housing agencies directly or outsourced but under government supervision. However, in recent times, the joint venture led provision is becoming one of the strategies to promote LcH provision in the country. The definitions of LcH used as used in developing country perspective apparently connote same meaning as affordable housing a commonly adopted term in the developed countries.

In a different context, LcH is a term to describe a concept that deals with cost effectiveness (budgeting and techniques) appropriate technology (Kumar, 1999; Civil Engineering Portal, 2013; Bajunid & Ghazali, 2012). By appropriate technology, it implies the use of locally available materials with improved skills and techniques without sacrificing the strength, performance, and life of the structure. However, this definition of LcH is not appropriate for use in the context of this study.

Drawing from the above reviews, the usage of the term LcH emerges from the perspectives as:

- An intervention strategy to meet housing needs of a particular population group.
- An appropriate technology advancement strategy.

This research is associated with the first perspective. Given the geographical area of this study (Nigeria) and drawing from NHP 2012, (cited in FMLHUD, 2012) LcH, as used in this study, can be defined appropriately. LcH is a government-led housing, comprised of multiple residential units located in same or several geographical areas, designed and constructed to reflect the incomes of projected beneficiaries, affording them the opportunity to upgrade as their income increases. This definition excludes any housing provided to the low- and Lower-Medium income group directly from the private sector for either profit, non-profit purposes or rental purposes. The projected beneficiaries are the low and lower-middle-income groups. LcH units could be bungalows as shown in Figure 2.2, low rise or even high-rise building developments.

Figure 2. 2: Model of Low-cost Housing in Nigeria

Source: Udo (2016)

2.3.2 Low-cost Housing Provision

LcH provision can be defined as a phased process encompassing a series of steps necessary to construct, supply, and maintain the houses (Ball, 2013). The provision process synthesis resources such as land, labour, finance and building materials are combined to produce and supply new housing units (Hecht, 2006). Ball (2013) describes these phases are interrelated with separate temporary activities that include initial purchase and assembling of the land, a conception of building design and schemes, the building construction, and the selling of completed houses. It is, therefore, a complicated process influenced by contextual characteristics of various stakeholders (private and public), management system and affordability capacity of target beneficiaries, which affects its design, construction, distribution and management (Sweeney-Bindels, 2011). In another word, provision involves an understanding and strategic implementation from planning, construction, to the distribution of new or renovated dwelling units to the end users.

Two important factors are necessary for considerations in LcH provision namely: the purchasing power of the household (the ability of the household to sustain the cost of housing consumption) and the production price of the housing (McNelis, 2014). Given these considerations, government interventions are strongly emphasized in many countries. Every country adopts a system through which LcH provision can be realised (Ball & Haloe, 2007).

It is quick to note that for adequate housing provision, every country will employ a system suitable with its contextual peculiarities. The systems are commonly referred to as a framework of housing provision.

Literature, documents various analytical frameworks for housing provision in different countries (Kemeny & Lowe, 1998; McNelis, 2014). Three commonly cited frameworks for LcH provision are:

- Structure of Housing Provision (SHP) developed by Ball (1986 cited in McNelis, 2014),
- Housing Provision Chain (HPC) developed by (Ambrose, 1991)
- International low-cost housing system (ILHS) developed by Burke (1993 cited in McNelis, 2014).

These frameworks have been adapted in various countries to meet contextual peculiarities of LcH provision. The SHP is a framework that provides an overview of the housing provision process, focusing on the social agents essential to that process and the relation between them (McNelis, 2014). In other words, housing provision is not merely a physical process but also a social process in which social relations are formed into a structure, (Ball, 1986b cited in Wu 1996). The HPC framework illustrates the linked system of the processes and relationship between the agencies and the various process stages. The HPC is comprised of five key stages:

- Promotion: this is the initiating stage of the housing development. The how, why and when are considered at this stage.
- Investment: this stage involves sourcing of finance to assemble factor input. It includes the finance to purchase the land, labour, and materials to make the unit.
- Construction: this stage involves the design and actual production of the dwelling units (referred to in this context as the LcH project delivery).
- Allocation: this stage involves the decision and transfer of the completed dwelling units to the project beneficiaries.
- Subsequent Management: this stage includes the management, maintenance, and possible conversion, reallocation and eventual termination of use.

Similarly, the ILHS identified four key provision stages:

- Production- is concerned with land ownership, land assembling, and housing production; Consumption- refers to the forms and method by which people and households consume the housing provided;
- Exchange- relates to the practices and institutions which facilitate the transfer of housing;
- Management- refers to the administration of the housing stock.

A critical review of all the provision process in the three frameworks shows some remarkable similarities. These similarities are summarised under four main headings.

- Land assembling,
- Project delivery
- Allocation and exchange
- Maintenance and management.

However, the influences of housing policy cannot be disregarded in discuss of housing provision. According to Clapham et al., (1990) housing policy is any form of intervention in the housing provision that affects the location characteristics, affordability, and ownership. The housing policy objectives of Government in housing provision can take the form of direct provision, financial incentives and regulation. These inherent characteristics regarding provider, management system, and beneficiary affordability, influences the LcH provision system adopted in a country. Therefore, understanding such contextual peculiarities is important to comprehend LcH provision in the context of the study. Based on this discovery, the next section reviews the concept of the LcH provision from the particular country context of Nigeria.

2.4 LOW-COST HOUSING PROVISION IN NIGERIA

This section discusses the LcH housing provision in the context of Nigeria. It starts with a description of the Nigerian background and moves on to discuss its housing and construction sector, a trajectory of LcH policies and supply and LcH provision framework.

2.4.1 Background of Nigeria as a Country

This section presents the geography, governance, population economy and construction and housing sector in Nigeria as a developing country.

2.4.1.1 Geography and governance structure of Nigeria

Nigeria is a developing country in Africa, located in West Africa, the Gulf of Guinea between Benin and Cameroon. It shares borders with Cameroon (1,690 km) to the east, Chad (87 km) in the northeast, Niger (1,497 km) in the North, and Benin (773 km). Nigeria occupies a total area of 923,768 km2 making it the world's 32nd-largest country. Colonised by the British, Nigeria gained her independence in 1960 and history documents that by 1963, the country had four regions. By 1967, 12 states were created out of the four regions and in 1976, seven additional states were created. In 1987, the number of states had increased from 12 to 21 states. In 1996, other states were created summing up to 36 states with a Federal Capital Territory (FCT) Abuja. These the 36 states and the FCT are grouped into six geopolitical zones across the country as shown in Figure 2.3.

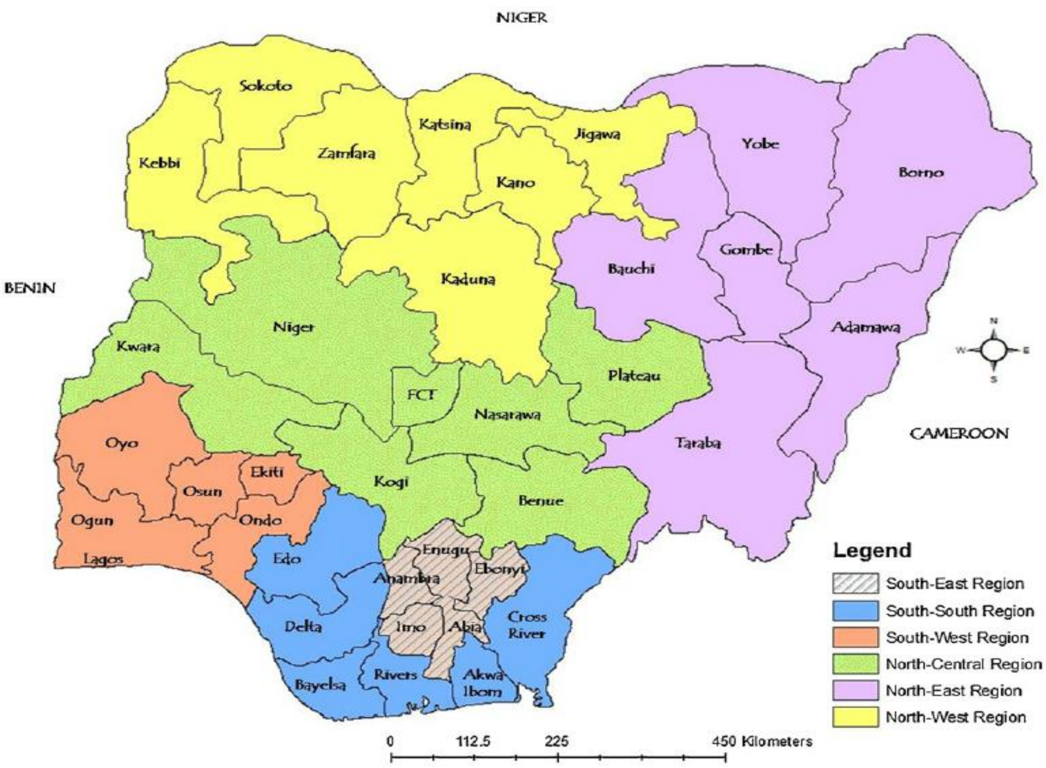


Figure 2. 3: Geographical Map of Nigeria

Source: Ekong, et al. (2012).

According to Obasi (2002), the Nigerian constitution describes the country as one indivisible and indissoluble sovereign state, whose constituent units are bound together by a Federal arrangement. The country adopts a system with three tier of government- the Federal, State and Local government. The functions of the various tiers embrace political, financial, judicial and administrative roles governed by the provisions of the constitution (Okafor, 2010). The country's government structure are in three levels- Federal, State, and the Local government. The number of Local Government Areas (LGAs) in the country has also been on the increase. Ndubueze (2009) documents that following the decentralisation policy and the periodic increase in the number of states, the government created 145 new LGAs in 1989 that totalled the number of LGAs in the country to 449. Additional 325 more LGAs were created bringing the current total number of LGAs in the country to 774.

2.4.1.2 Population Background of Nigeria

In 2015, Nigeria ranked world 7th most populous country with an estimate of 182.2 million persons representing about 2.35 percent of the world´s total population (Trading Economic Report, 2016). Hence, approximately one person in every 43 people on the planet is a Nigerian (Trading Economic Report, 2016). The Nigerian population has grown drastically over the years (Figure 2.4) from 143.3million in 2006 to 182 million in 2016. This growth in population conversely influence the population density per square kilometre which has risen from 149.3 in 2004 to 180.3 in 2012 (Ajanlekoko, 2001; NBS 2015). The population growth and density pressures on housing demand and need. Unfortunately, housing supply has not been able to meet up to demand resulting in growing slums and substandard accommodations across the country.

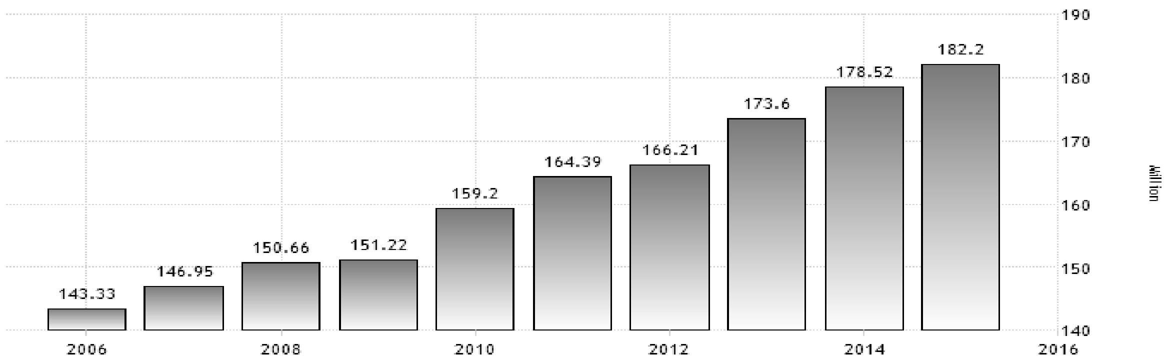


Figure 2. 4: Nigerian Population trend

Source: National Bureau of statistics Nigeria (cited in Trading Economics Report, 2016)

The National Housing Policy reported in the FMLHUD (2012) show that a vast majority (up to 80 percent) of the Nigeria population are fall under the No-income, Low-income, Lower-medium income. These groups when classified by salary structure fall within level 1-9 grades as shown in Table 2.2 earning a maximum salary not exceeding four times the National Minimum Wage.

Table 2. 2: Nigerian Population group classification

	Population group classification	**Description**	**Grade**
1	No income	Monthly Income does not exceed 25% of the National Minimum wage	No grade level
2	Low income	Income does not exceed the National Minimum Wage	Grade 1-3
3	Lower-Medium income	Monthly income does not exceed four times the National Minimum Wage.	Grade 4- 9
4	Upper middle and High income	Monthly income exceeds exceed four times the National Minimum Wage	Above 9

Source: Compiled from Pindiga (2010), FGN (2012) and Jolaoso et al. (2012)

The percentage rates of Nigerians living in absolute poverty (those who cannot afford the essentials of food, shelter and clothing) have risen from 54.7 percent in 2004 to 60.9 percent in 2010 (NBS 2015). Inequality, as measured by the Gini Coefficient, has also risen from 0.429 in 2004 to 0.447 in 2010 (Oyewale & Musiliu, 2015; NBS, 2015). This is consequent to why many Nigerians cannot afford adequate housing and depend largely on government intervention to meet the basic needs of life.

2.4.1.3 Economy Background of Nigeria

Nigeria is described economically as a resource-rich lower middle-income country with a Gross Domestic Product (GDP) worth $568.51 billion making it the largest economy in Africa and 23rd largest in the world (Okonjo-Iweala, 2014; World Bank, 2015). In spite of the decline in economic growth from 7.4 percent in 2011 to 6.6 percent in 2012, the attitude for growth of the Nigerian economy remains positive. The Nigerian economy is largely driven by capital-intensive sectors (Mosaku, et al., 2006) as illustrated in Table 2.3. The petroleum and gas sector contributes the highest to the GDP. Other significant contributing sectors are utility, manufacturing, construction and housing.

Table 2. 3: Sectoral breakdown of the Nigerian economy

Sector	Real GDP (₦ Billion)	Real GDP (₦ Billion)	Annual Change (%)		Contribution Growth (%)	
	2009	2010	2009	2010	2009	2010
Other industries	187.03	197.91	2.85	5.81	11.09	19.23
Petroleum and gas	117.12	122.96	0.45	4.98	1.13	10.32
Manufacturing	29.99	32.28	7.85	7.64	4.67	4.05
Utility	23.73	24.52	3.23	3.32	1.59	1.39
Construction and housing	13.82	15.48	11.97	12.08	3.16	2.86

Source: Isa et al. (2013)

2.4.2 The Nigerian Construction and Housing Sector

The NBS (2015) report reveals that this sector is concerned with the development and maintenance of infrastructure (roads, bridges, railways, etc.), housing and commercial real estate. It is a significant sector satisfying a broad range of physical, economic and social needs of individuals and the nation as a whole (Shittu & Shehu, 2010; Okonjo-Iweala, 2014). The relevance and growth of this sector over the years are associated with high demands caused increasing population, the need to open up communities to foster interstate and inter-regional trade and movement (NBS, 2015). The construction sector comprises of the building, equipment and transport subsector and their Gross Capital Formation (GFC) as shown in Table 2.4. The GCF by fell by 8.91 percent from ₦204, 665.57 million in 2010 to ₦186, 439.63 million in 2011 and 121,900.86 in 2012. However, under the building subsector, housing construction has remained on the increase within these years. This statistics suggests that housing construction is one of the key components with consistent significant contribution to the GCF and the sector as a whole.

Table 2. 4: Gross capital formation of the Nigerian housing and construction sector

Sub-sector	2010	2011	2012
Building			
Purchase or housing construction	1,994.95	3,465.26	4,137.30
Purchase or construction of non-residential building	2,258.78	2,824.89	3,353.06
Purchase or construction of other building structures	1,822.73	2,308.10	2,828.17
Major repairs and renovation	1,825.15	2,579.58	2,976.34
Equipment			
Purchase of machinery and equipment	190,227.59	168,769.17	103,327.66
Purchase of office furniture and equipment	718.07	1,381.98	911.60
Transport			
Purchase of transport equipment	5,818.31	5,110.66	4,366.72
Total gross capital formation	204,665.57	186,439.63	121,900.86

Source: National Bureau of Statistics in Nigeria (NBS) (2015)

Over the years, huge resources have been committed to housing development in Nigeria. A boost in the housing development is one of the salient features to achieving Nigeria's quest to become one of the top 20 economies by 2020. It is significant to achieve sustainable growth and development of the Nigerian populace and economy (Okonjo-Iweala, 2014). Also, the Global Construction Report (2015) projections are that the Nigeria housing market will be the fifth largest in the world after the United States. In their view, this ranking is occasioned by the expected estimated average housing production output of 1.5 million units per year from 2015- 2025. This report suggests that housing will in no doubt remain an important component of growth to the populace, housing and construction sector and the Nigerian economy in general.

There are two main categories of housing in Nigeria: private and public housing. These taxonomies have emerged based on the characteristics of their providers who can be individuals, private sector or government. These providers promote or facilitate the construction of a building without a presumptive right of use to the building (Keivani & Werna, 2001; Ndubueze, 2009). Often times, the interests of the providers are transitory and may vary during one or more phases of provision (Kernohan & Gray, 1992 cited in Ogbu & Adindu, 2012). An overview of the housing types and their providers will facilitate a better understanding of the concept of LcH provision in Nigeria.

2.4.2.1 Private Sector Housing

The private sector housing in Nigeria as referred in this context is housing developed and provided directly to the real estate market by non-government agencies such as individuals and commercial real estate developers with the view to make a profit (Ndubueze, 2009). According to the FMHUD (2012), this sector has remained a dominant sector in the Nigerian housing sector. In fact, the NHP report acknowledged that the sector accounts for over 90 percent of the housing stock in the country. An overview of its providers are subsequently discussed:

- *Individual providers*

Evidence shows that more than 70 percent of the total urban housing stock, owned or for rent in the Nigeria housing sector, is provided by individuals (Ndubueze, 2009). Apparently, this situation has really not changed. The individuals build for personal use and rent some of the rooms to low- incomes to recover money from the housing investment or to augment household income. This is usually the case in many low-income housing neighbourhoods. There are also other cases where the individuals specifically invest to provide the houses provision for clear commercial purposes.

- *Private developers and Institutions*

The role and scale of these providers in the housing sector in the country are growing especially in recent years. These providers to the real estate market comprise three categories of developers namely: the large-scale construction firms, multinational co-operations, institutions, and the small and medium-scale property development firms. According to Ndubueze (2009), the housing provided by the private construction firms are clearly beyond the reach of most Nigerians, particularly of the low and lower middle-income households in most Nigerian cities. The large scale housing construction firms are involved in large-scale urban housing construction and estate developments. The medium scale housing construction firms participate in the employees' housing schemes that were established by the Special Provisions Decree No.54 of 1979 (as amended), which was meant to encourage these firms to provide adequate housing for their staff. Both large and medium scales mostly cater for the high and middle-income private housing sub-markets and in staff housing programmes.

The small-scale housing construction firms are usually engaged in providing housing for high and upper-middle income groups within the urban areas in the country. Their presence in the Nigerian housing sector dates back to the 1960s and tend to concentrate in developing prime high end expensive residential housing in and around places like Lagos, Abuja, Port Harcourt, Enugu, Owerri, etc. Some of the private property development firms include G. Cappa, Julius Berger, Property Development Company (PDC), Shell, and various banking institutions (Ndubueze, 2009). The small-scale firms constitute the most dynamic group within the private sector housing. However, there is no official data accurately determining their level of impact.

- *Cooperative and non-governmental charity organisations*

These providers refer to non-governmental organisations as NGOs. Many are no more than social clubs that provide ambulance and basic social services generally believed to complement the effort of the government by assisting the vulnerable target groups to access adequate housing (Agbola, 1994). However, they are yet to make any significant impact on the Nigerian housing sector, though the community-based organisations (CBOs) play active roles in grassroots mobilisation to housing provision at the community level. The CBOs have significantly contributed to the construction of community infrastructure and services through self-help and grassroots engagement. Existing CBO structures at the grassroots offer a viable opportunity for partnerships at the community level towards implementing government LcH programmes.

2.4.2.2 Public sector housing

Public sector housing in this context refers to government owned, built, or sponsored housing. There are two major types of public sector housing. The expensive high incomes housing and LcH. These two type of housing aim to provide housing for government employees, such as civil servants, public officers, and government officials and for the general populace.

- *High-income housing*

The houses are developed and allocated to public servants, and government employees or certain grades and category of staff at a small fixed rent deducted monthly from their salaries. About 25 percent of civil servants acquire accommodations through this type of housing.

These houses are sectionalised to cater for high government employees in the government residential areas (GRAs) or designated surrounding environs. Public housing in the government residential areas (GRAs) are virtually in all major Nigerian cities. They originated during the British colonial era to accommodate the increasingly large number of colonial administrators and executives of the main commercial firms coming into the country during the late 1920s. Housing types in the GRAs are often located on large plot sizes and open spaces and are western styled single-family houses (Ndubueze, 2009). With the departure of many of the British on Nigerian Independence, the GRAs have provided a highly subsidized expensive housing for high-ranking government officials.

- *Low-cost housing*

This type of public sector housing aim at providing adequate housing for those on Low and lower-medium incomes (Government employees or general public) and are usually located in surrounding GRA or city outskirts. The FMLHUD, (2012, p. 3) defines LcH provision as the:

> "the process of simultaneous production (building) to target prices of large number of decent, safe, sanitary and affordable residential buildings with secured tenure; on a continuous and permanent basis with adequate physical infrastructure, amenities and social services in a planned, healthy and liveable environment to meet the basic and special needs of the population and reflecting their socio-economic and cultural aspirations and preferences".

The government provides LcH through the housing agencies to those within the lower/middle cadre in need of adequate housing. LcH is far less glamorous than high-income housing. In contrast, they are basic in design and standards with adequate infrastructure and are located in high-density neighbourhoods. They consist one or two bedroom apartments in detached, semi-detached, or row houses on much smaller plot sizes. Ndubueze (2009) argued that this housing type is the most contentious and the most discussed type of public sector housing in the Nigerian housing sector. Sometimes the government agency in charge may contract to private construction organisation for the actual construction of these houses. On completion, the LcH are allocated to government employees or sold to the public at a subsidised price but are managed by the housing agencies. This management services are seen to be mainly administrative and not for maintenance purposes and are yet a complicated area beyond discussion for this research. In the past few decades, LcH production took a drift from direct government construction to on-going pro-market civil service reform (Talba, 2004 cited in Ndubueze, 2009; FMLHUD, 2012). However, owing to the enormous housing deficits affecting a vast majority of the low and lower- medium-income group, there is a new drive stimulating government direct involvement once again. The redirection by direct government involvement in LcH project delivery is one of the reasons this study has come to the fore.

Having identified the peculiar features of the Nigerian housing sector, and identified the LcH as a government-led public housing, the next section discusses the context of LcH policy in Nigeria.

2.4.3 Nigerian Low-cost Housing Policy

The provision of LcH in Nigeria apparently dates back to 1962 after the Nigerian national independence, and like many other countries, it is also a strategic intervention by government to provide adequate housing to those within the low and middle-income group (FMLUHD, 2012). The houses are residential buildings ranging from one- three bedroom units of a single-family house or flats (low and high-rise). Records as shown in the NHP in FMLHUD (2012) reveal that the evolution of Low-cost Housing started out as a government strategy to increase the housing stock and provide shelter for many civil servants who moved into the then federal capital Lagos. It mainly gained the term LcH following the World Bank initiative of housing to the poor in 1979. The LcH initiative promulgated by the World Bank started out in the eastern and northern regions now referred to as the southeast and northeast zones, particularly in Imo and Bauchi states and the other states across the country. Before 1979, the LcH had evolved in the southeast zone, due to the emergency to build houses for the workers from the former East Central State of Nigeria. The houses were prefabricated, and core housing located in government reserved housing estates. Since the 1960s, different housing programmes and policies have been implemented at federal zonal and state levels geared towards the provision of adequate housing across the country.

In the 1960s and early 1970s, policy directions in LcH provision involved direct construction by public agencies. The Nigerian Crown Colony, 1946, stated, "…*steps should be taken to ensure that the provision of proper amenities and the improvement of housing and living conditions should be given simultaneous attention*." (Cited in Ndubueze, 2009, p. 25). In this regards, the Nigerian Building Society was established as a mortgage institution, African Staff Housing Fund was to provide housing finance to encourage urban house homeownership of native public servants within the class, and the Regional Housing Corporations were to provide direct housing to the public. Despite these developments, the Nigerian urban housing conditions worsened. The influx of workers and people to the capital city, then Lagos after the Independence, created a demand for more housing. The financial provision was made by LEDB for more Low Income Housing estates in Lagos, and the five-year National Development Rolling Plan (NDRP) was organised. The lack of adequate attention on the housing sector and the outbreak of the civil war in 1967 were major challenges that limited the successful implementation during this period.

The government initiated between 1975 and 1980 a new National Housing Programme especially at the federal and state government levels based on the acceptance that:

> "…it is part of its social responsibility to participate actively in the provision of the housing estate for all income groups and will, therefore, intervene on a large scale in this sector during the plan period. The aim is to achieve a significant increase in the supply of social housing (public) housing estate and to bring relief especially to the low-income groups who are the worst affected by the current acute shortage" (Federal Republic of Nigeria, 1975, p. 308).

Government position as the principal provider of housing for its citizens re-initiated the public housing programme with emphasis on LcH provision in the 1970s. This time, the government intervened in the direct housing provision to moderate informal private sector dominance in the housing sector. Within this said period, five institutions were created. The National Council of Housing, the National Housing Programme, the Federal Housing Authority (FHA), the Federal Ministry of Housing, the Urban Development and Environment (FMHUDE) which later became the Federal Ministry of Works and Housing (FMWH) were established in 1971, 1972, 1973, 1974 and 1975 respectively. The reasons for the establishment of these institutions were to initiate and coordinate nation-wide programmes and policies on the housing provision.

In 1977, the Nigerian Building Society was converted to the Federal Mortgage Bank of Nigeria. LcH then known as the Shagari Low cost houses was instituted in all the nineteen states through the federal ministry of housing and environment. The World Bank Assisted

Nigerian States Urban Development Programme (NSUDP) also initiated a National Low Cost Housing Programme in 1979. Despite these ambitious and continued efforts by government, the housing problems in the country and particularly the urban centres apparently worsened. Ogu and Ogbuozobe (2001) and Ikejiofor (1999), blamed it on rapid population and urbanization growth. However, it is also traceable to the many failures in the delivery of the various proposed housing schemes giving rise to the housing deficit across the country.

The urgent need for change in strategies to address housing need re-launched the NHP in 1991. The aim of the NHP was to ensure that "*all Nigerians own or have access to decent, safe and sanitary housing accommodation at affordable costs by the year 2000*" (FMLHUD, 2012 P. 17). One of the main strategies to achieve this aim was the creation of National Housing Fund Scheme through which beneficiaries can have access to ownership of the low-cost housing units. The Primary Mortgage institutions disburse the funds under supervision by the Federal Mortgage Bank of Nigeria. Secondly, the self-help, the national sites, and services scheme and the Urban Renewal and Slum Upgrading Scheme were re-energized. In 1996, the FHA released a total of 1,090 hectares of land to accommodate over 5,000 housing units in FCT Abuja.

The FHA and FMW through the National Housing Programme and prototype housing scheme, set out directly to develop 121,000 houses in several states of the federation. However, the plan was not executed and only minimal success could be achieved. The many failures of the various LcH schemes and strategies led to homelessness of about 60 percent of Nigerians (FMLHUD, 2012). To re-assure, the populace of government's commitment to eradicating homelessness among Nigerians the new Civilian Administration proposed a new housing programme. This programme proposed the provision of five thousand (5,000) housing units per annum throughout the Federation for four years. Unfortunately, it was also not successful. The failure was due to inadequate housing delivery system as well as the ineffectiveness of the FMW in providing solutions for the housing needs of the nation that called for the need for a review of the 1991 housing policy.

In 2011, a new NHP was drafted, revised and endorsed by the National Council of Lands, Housing and Urban Development (NCLHUD), and the National Economic Team. The revised NHP gained approval by the Federal Executive Council (FMLHUD, 2012) in 2012. The aim of the revised NHP is "*To ensure that all Nigerian own or have access to decent,* *safe, and sanitary housing in healthy environments with infrastructural services at affordable cost, with secure tenure...*" (FMLHUD, 2012, p. 40). One of its objectives is that each state "formulate its housing programmes within the overall framework of the NHP…; establish appropriate agencies and utilize State Housing Corporations/agencies to develop and manage the housing programmes."(FMLHUD, 2012, p. 84). At present, all housing agencies in all the states across the six geopolitical zones in the country are implementing the NHP objective through various plans. One of the strategies adopted is the provision of site and services through the FMLHUD and sustainable LcH provision. The FHA also proffered a Sustainable LcH delivery methods /targets model to facilitate the delivery of 106,000 housing units annually (Figure 2.5). This model integrates both public and private sector involvement in the direct mass construction of LcH with the government maintaining continued effort in providing LcH through their designated Ministry/Agency at all levels. The housing corporation and agencies at the state and local government levels are expected to facilitate the sustainable construction of 100,000 – 200,000 LcH units annually nationwide.

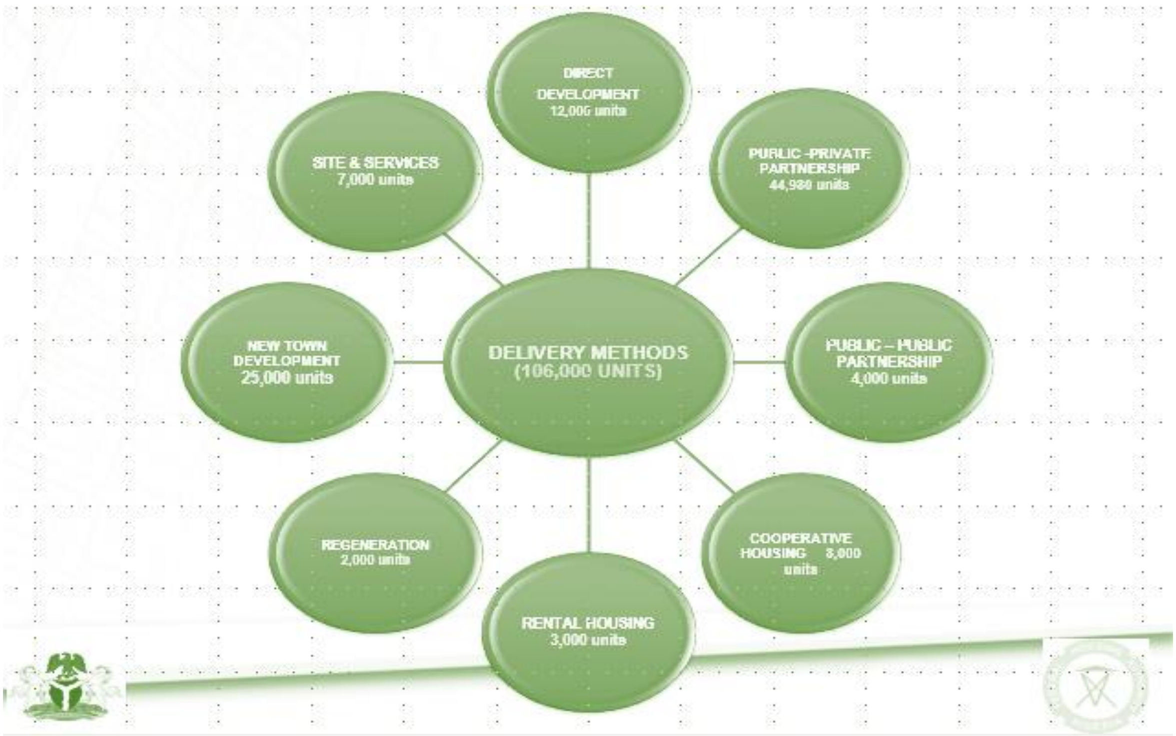


Figure 2. 5: Sustainable low-cost housing delivery methods /targets

Source: Gemade, (2012)

An appraisal of housing policy in Nigeria shows that LcH provision is an integral part of the NHP and programmes in Nigeria to meet the housing need of a vast majority of the low and lower- medium income groups. However, the demand for LcH will continue to grow given growing rates of population, urbanization, poverty, etc. That is why it has been argued that government continued intervention in the direct development of LcH is necessary because it may be impossible for the vast majority of the populace in Nigeria to access adequate housing (Olotuah, 2010; FMLHUD, 2012). The continued need for improved LcH development has formed the centre of discourse among scholars involved in the Nigerian housing studies. One of the argument according to Kalu et al. (2014) is that governments should not relent in their massive investment in LcH development until the housing problems are reduced to a bearable minimum. Hence, rather than just depending or adopting systems from developed countries that is challenging to implement in the Nigerian context, government should embrace policies and systems that can facilitate effective LcH provision putting into consideration the contextual peculiarities of the country. In agreement with this view, housing provision for the low and lower-medium income groups cannot be left totally to market driven forces considering the Nigeria’s contextual characteristics. Hence, to improve the quantity of LcH supply and its affordability by projected beneficiaries, the government on their part need to maintain continuous involvement in its production through its housing corporation and agencies.

2.4.4 Low-cost Housing Supply in Nigeria

Evidence show that between 1961 -1970, out of 61000 housing units projected supply only about 500 houses were constructed and supplied. This poor performance initiated the first National Development Rolling Plan (NDRP). The first NDRP of 1971-1975, proposed the construction and supply of 59,000 housing units, 15,000 in Lagos, then national capital, and 4000 units in each 12 states of the federation. However, records show that only about 7080 accounting for 12 percent of the proposed housing units were built by the end of the programme (Ademiluyi, 2010). The second NDRP between 1975 and 1980, kicked off with 202,000 units proposed development. 50,000 housing units were to be built in Lagos and about 8,000 units in each of the (then) 19 states of the country (including Imo and Anambra States) at an estimated total cost of N2.6billion (FMLHUD, 2012; Ademiluyi, 2010). Also, the World Bank LcH scheme commenced remarkably in Bauchi and Imo State at an estimated scheme cost of N24.6million and N63.8million respectively. Similarly, with the first NDRP, only 28500 units were completed and supplied across the country.

The third NDRP commenced in 1981-1985. This programme embarked on a yearly construction of 40,000 units (2000 in each state including the Federal Capital Territory (FCT) at a projected sum of N1.9billion. The housing development (one, two and three-bedroom units) targeted low and middle-income earners whose annual income at the time did not exceed five thousand Naira (₦5,000) and eight thousand Naira (₦8,000). Evidence from the FMLHUD (2012) revealed that with 600 million Naira (₦600m) spent, only 32,000 housing units were completed contrary to expected 120,000 units by 1983. An additional 20,000 2-bedroom LcH units also proposed failed to commence in most States.

During the military regime between 1986 and 1993, no housing programme was initiated across the country. In 1994, however, a new direct public housing programme was re-launched. 1,090 hectares of land was released to accommodate over 5,000 housing units in FCT Abuja. 121,000 housing units were also proposed for development in several states of the federation. The FHA and FMW were mandated to directly construct this prototype housing scheme. However, following several challenges only 1,136 housing units representing 0.9 percent of the total 121, 000 housing estate units were constructed by 1998 (Ademiluyi, 2010). In 1999, when a democratically elected civilian government succeeded about 60 percent of Nigerians were reportedly homeless due to the shortage in housing supply amidst other factors (FMLHUD, 2012). The inception of the new civilian administration, spurred a new housing programme to re-assure its citizen of the commitment to the housing provision and eradicating homelessness.

This programme targeted at providing 5,000 housing units per annum throughout the Federation for four years. Both direct project delivery through government agencies and private, public partnership scheme were employed. Unfortunately, between 2000 and 2007, only 8,585 housing units were constructed and supplied across ten states including FCT Abuja. Many projects in states within the Southeast zone were not executed. No recorded success was established from 2007-2010. Between May 2011 and June 2013, 16447 LcH units were completed and supplied across many states in the country. Between 1961 and 2014, approximately 582,000 housing units were proposed under these various programmes, but only about 84,000 representing 15 percent of the units were actually constructed and supplied representing 15 percent. A summary of the trajectory of LcH supplied in Nigeria over the years is shown in Table 2.5.

Table 2. 5: Trajectory of Low-cost Housing Supplied in Nigeria

Housing programmes	Proposed scheme	Proposed LCH units	Completed LCH units
1961 -1970	Housing estates in Lagos	61, 000	500
1971- 1975	LCH units across the country	120,000	7080
1976- 1980	LCH units across the country	202,000	28500
1980-1985	LCH units across the country	120,000	32,000
1994-1999	LCH units	121,000	1014
1999- 2007	LCH units	148,000	8585
2010- 2014	LCH across the country	700,000	43,126

Source: Compiled by researcher from Akinde (2012) and FMLHUD (2012)

Findings from reports on the trajectory of LcH provision since 1960 till 2014 reveals that so many housing schemes have been initiated under various policy directions; such as slum clearance and resettlement, public housing schemes, sites-and-services, settlement upgrading and LcH schemes (Okoroafor, 2007; Aribigbola, 2008). However, many programmes recorded minimal success in implementation particularly in the southeast zone (Ogbu & Adindu 2012; Ugonabo & Emoh, 2013). This performance over the years has contributed to the increasing housing shortage estimated at 17 million units. This deficit is almost half the size of housing deficit in South Asia as a region (Nevano, 2010). Consequently, the federal government through the Vision 20:2020 has initiated yet another LcH development scheme in all zones. The housing sector is expected to produce at least 720,000 housing units annually across various zones across the country increase the housing stock, meet current demand, and avert any further housing crisis by 2020 (FMLHUD, 2012) . Therefore, LcH provision will yet receive considerable attention in the Nigerian housing sector and especially in the southeast zone in the near and far future. However, to ensure successful LcH provision, there is the need for successful performance in that each phase of the process. This success can be effectively realised by identifying critical areas in the provision system where necessary improvements are required.

2.4.5 Framework for Low-cost Housing Provision in Nigeria

The provision system for LcH provision in Nigeria is implemented under two main institutional management tiers. The first tier operates at the federal level where LcH programmes are executed under the sponsorships and coordination of the Federal Housing Authority (FHA) (Kabir & Bustani, 2012). The FHA undertakes the responsibilities to facilitate the effective provision of LcH units across all the zones in the country. Its responsibilities, amongst others, included the implementation of housing programmes as approved by the Federal Government (Kabir & Bustani, 2012). The FHA takes responsibility to supervise policy implementation and housing provision across the entire states in the country.

On the other hand, the second tier operates at the state level where LcH programmes are executed by the State Housing Corporations (SHC) under the sponsorship and organisation of the State Government Housing Implementation Programmes. The SHC is responsible for the implementation of approved policies and programmes within the state. The State Government may vest the services of the SHC range from, location, design, construction, allocation/sale of housing units to target beneficiaries, and subsequent management of the housing estates and other property (FMLHUD, 2012). Hence, each state in the in the country has an established SHC. The Imo state housing corporation (ISHC) is purposively selected for understanding the role of the SHC.

Existing evidence reveals that the ISHC is one of the first SHC established in the zone and was the first SHC in the zone and country as a whole to flag the LcH programme in the 1970s. Furthermore, the guidelines as used in many of the SHC in the southeast zone derives from the ISHC. Hence, the ISHC can be considered a representative SHC of the five (5) states housing authorities in the southeast zone. The ISHC was established in 1976 following the need to accommodate the civil servants who had pressing needs for housing at the time and to expand the scope of the housing sector of the economy of the state. The then government of Imo State under Act No. 14, 1976, established the ISHC charged with the following responsibilities:

- Build houses for sale to the public;
- Develop estates for the building of houses;

- Carry out maintenance services for all the estates under the administration of the corporation;
- To provide estate management expertise for the houses built;
- To provide home-ownership through mortgage band subsidy;
- To provide rented houses for both the high, medium and low income groups;
- To provide serviced plots for industrial and commercial purposes;
- To provide consultancy services for architectural design and construction and housing research where possible;
- To award contracts for the development and construction of access roads and other facilities of like nature that are necessary in modern layouts of housing estates or other buildings owned or managed by the corporation;
- To implement housing schemes of the state government in all the local government areas.

To support the corporation, the state government is responsible for providing land with a certificate of occupancy to the corporation, grant planning approval and providing necessary support to facilitate the execution of the housing project. The corporation armed with these provisions proceed to the design and construction of the LcH estate either as fully/partly developed housing units or as site and services scheme and sell the plots of varying sizes to the targeted government employees or members of the public.

Both the FHA and the SHC have been responsible for implementing various housing policies and schemes at both federal and state levels in the country. These bodies are considered project sponsors acting on behalf of the state and federal government serving as surrogate owners and take charge of making necessary arrangements for design, construction, financing and sales of completed housing units. The FHA and SHC employ a provision framework to execute various LcH schemes. The NHP (1991, cited in Akinde, 2012) clearly highlights a framework for LcH provision in all the various states in Nigeria. The framework shows five distinct but interrelated phases:

- Acquisition of the site
- Obtain legal rights with which to begin work on the site

- Development schemes including approval from public authority
- Project execution and completion
- Commissioning of houses followed by their sales to beneficiaries and general public at subsidised price.

A clearer description of the LcH provision framework used in Nigeria was documented by Onyeacholem (1991) and depicted in Figure 2.6. This framework embodies the various processes through which LcH schemes are implemented from policy formation to construction, demolition and redevelopment. This framework comprises of six phases and is similar in content to the Housing provision chain proffered by Ambrose (1991). An overview of the six phases are as follows:

- *Policy formulation phase:* This is the initiating stage of the housing provision process. The stage considers what is needed, how and where it is needed, and who would be responsible. The NHP is adopted in all the zones across the country and implemented via various state initiated LcH schemes.
- *Land provision phase:* This phase involves the land acquisition through the state government and made available to the FHA and SHC for LcH developments.
- Acquisition of capital and financing phase: Having made land available, this phase make finance available for the project. It involves sourcing of finance to assemble the input factors for the purchase or compensation of the land and to fund the LcH project.
- *On-site service provision phase:* This phase involves the provision of infrastructure, such as internal roads, water, electricity, and sewerage within the mapped out development area. However, the provision of the services is performed through the separate government agencies for which the housing agencies have no direct control; i.e., such as the ministry of works.
- *Dwelling construction phase:* This phase involves the design and actual construction of the LcH developments, i.e., the project delivery phase.
- *Occupancy phase:* This phase involves deciding who lives in the completed housing units, either by allocation and/or by subsequent post construction housing management. The rehabilitation, demolition, and redevelopment involves the

maintenance, possible conversion, re- allocation and eventual termination of use. However, the occupancy phase is given less consideration in Nigeria because management services offered by the housing agencies are seen to be mainly administrative and not for maintenance purposes.

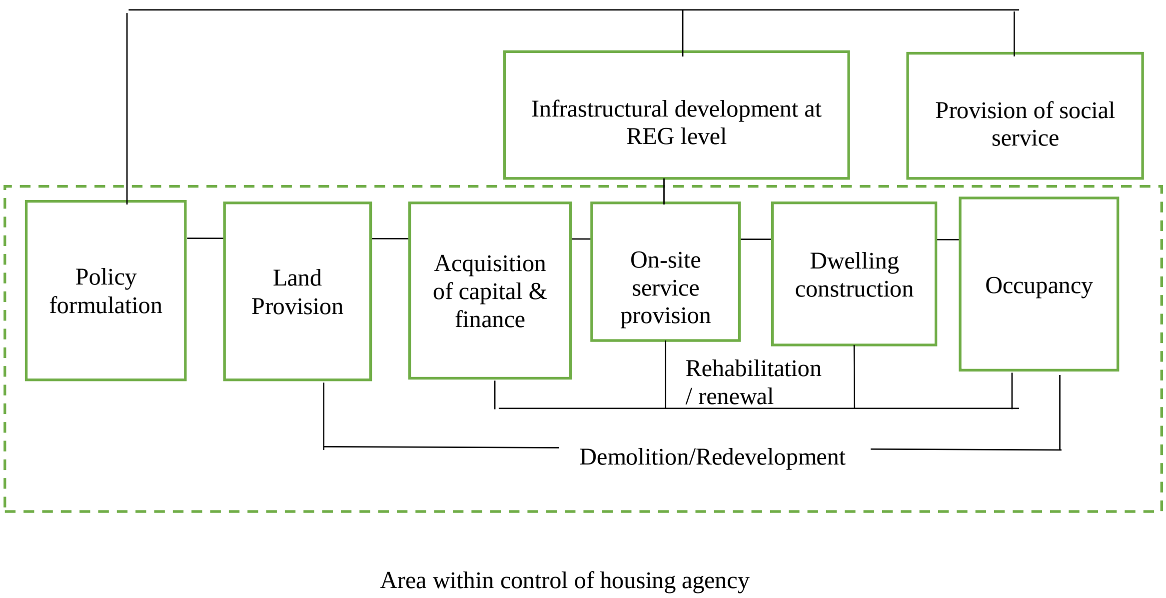


Figure 2. 6: Framework for LcH provision in Nigeria

Source: Onyeacholem (1991)

A review of LcH provision framework in Nigeria emphasise the project delivery phase as an important stage in LcH provision (Onyeacholem, 1991; Akinde, 2012). Over the years, LcH project delivery is one phase that has attracted considerable attention by various scholars (Ogu, 1996; Okoroafor 2007; Ogbu & Adindu, 2012; Akinde 2012; Obi & Arif 2015; Amade, et al., 2015). This attention results from the considerable impact of the performance of LcH project delivery on the quantity, quality, and affordability of the houses (Onyeacholem, 1991). As espoused by Dinsmore and Cabanis-Brewin, (2006), it can be likened to the product creation stage. Although this stage consumes a relatively small portion of the product life in terms of time and cost, its success is critical to the performances of subsequent stages in the life of the product. This discovery, make this phase one of the significant areas to improve successful performances. In otherward, effective performances of the project delivery phase can improve the success rate of LcH programmes. Therefore, careful attention needs to be accorded to this phase to identify strategies that can lead to successful LcH project delivery across the country. Proffering one of such effective strategies that can eventually improve LcH project delivery is the entire focus context of this study.

2.5 LOW-COST HOUSING PROJECT DELIVERY

This section discusses the LcH housing project delivery from global to the Nigerian context. It starts by defining a project and goes further to appraise its peculiarities in procurement, project team and success criteria.

2.5.1 Definition of a project

Projects as temporary production systems (Ballard & Howell, 2003). According to the definition by the Project Management Institute (PMI), (2008 p. 5), a project is “a temporary endeavour undertaken to create a unique product, service and result”. Projects are highly-valued, time bound, special construction aimed at constructing a facility or service within predetermined performance objectives, defined in terms of quality, specification, completion time, budgeted costs and other specified constraints (Chitkara, 2011). Hence, projects are as temporary interrelated events with defined beginning and end and completed within available scope and resources constraints through the management of a group of expertise. Saqib et al., (2008 cited in Gudienė, Banaitis, & Banaitienė, 2013) described a construction project as a combination of many events and interactions, planned or unplanned, over the life of a facility, with changing participants and processes in a constantly changing environment. Hence, projects are accomplished within complex environs of numerous interdependent but interrelated activities bringing together human and non-human resources into a temporary organisation headed by a project manager.

Construction projects are categorised into building projects, Infrastructure and industrial projects. Building construction projects is further dived into housing (residential) and non-residential projects (Kirkham, 2007; Chitkara, 2010). Residential or housing construction projects are developed for the living space of individual people or families; e.g., individual home, multifamily dwellings, condominium, small/ simple apartment, etc. Consequently, LcH projects is one type of housing construction project. Therefore, it is worth defining the characteristics of this type of construction project.

2.5.2 Definition of Low-cost Housing project

LcH projects are classified under residential building projects with Government roles policies and laws regulate its development. Kwofie et al. (2014), and Adinyira et al., (2012) describe LcH projects as multiple residential housing developments with standardised design and construction, usually located in the same area or several geographical locations and implemented under same project scheme management and contract. Because of these unique features, they differ significantly from one-off projects and, thus requiring well-structured management styles for enhanced success in their delivery (Ahadzie & Amao-Mensah, 2010; Adinyira et al., 2012). Therefore, massiveness in size, location, project sponsor, standardisation, design, construction and management style are all the features that characterised such projects.

LcH projects are executed to meet the defined terms of quality, cost and time requirement that have been identified through various interactions between the government housing agencies and the target beneficiaries which are mainly the low and lower-middle income (Ogbu & Adindu, 2012). Therefore, they constitutes complex project environs, operating concurrently across regions or states within strict timeframe and budget constraints and, thereby competing for scarce resources. The peculiarity of various criticalities, needs and maturity of circumstances from proactive community involvement, a myriad funding sources, procurement route, location design considerations and affordability by target beneficiaries are some of the characteristics affecting LcH projects delivery.

2.5.3 Low-cost Housing Project Delivery

Project delivery involves numerous parties, various processes, different phases and stages of work, and a great deal of input from both the public and private sectors, to conclude a project successfully (Takim, 2002). Project delivery embodies a process by which all of the procedures and components of designing and building a facility are organized and synthesised to obtain the desired results at completion. This is also the concept in LcH project delivery and entails how the project moves from an idea to design and constructed (Akinde, 2012). Project delivery process involves key sequential steps followed in project executions. According to PMI (2008), this process is a cycle that involves the initiation, planning and design, execution, monitoring, control and closing. Smith (1999) expressed this cycle in eight operational stages namely pre-feasibility, feasibility, design, procurement, implementation commissioning handover and operation. Various countries have adapted these operational stages in their construction frameworks, to meet their country’s contextual characteristics (Graf & Heise, 2014). The Royal Institute of Architect (RIBA) plan of work is an example. This plan shows an operational view of the project delivery cycle in relation to the project delivery phases. This plan is a design and management framework for delivery of building projects including LcH project delivery in the United Kingdom. The plan as depicted in Figure 2.7 highlights the requirement for successful project delivery to help project stakeholders understand the requirements to facilitate successful project delivery. The plan of work documents the key operations for each stage (strategic definition – handover and close out) of the project delivery process and have evolved over the years to meet up with contemporary practices in the construction environment.

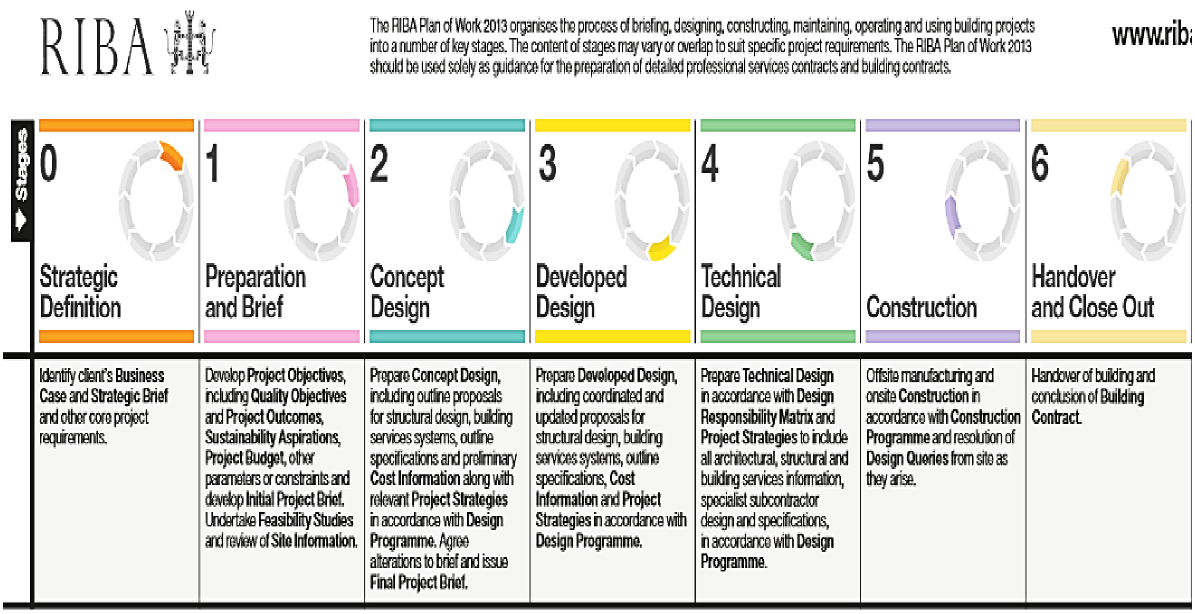


Figure 2. 7: RIBA Plan of works (2013)

Source: Royal Institute of British Architects

This plan is also adopted for LcH project delivery. Harriot and Matthews (2009) developed a contextualised guideline from the RIBA plan of work for LcH project delivery based on experiences of members of the Chartered Institute of Housing in the United Kingdom. The guideline highlights considerations in three key stages of LcH project delivery as depicted in Figure 2.8. It is expected that project and housing managers understand these essential considerations for successful LcH project delivery in the UK.

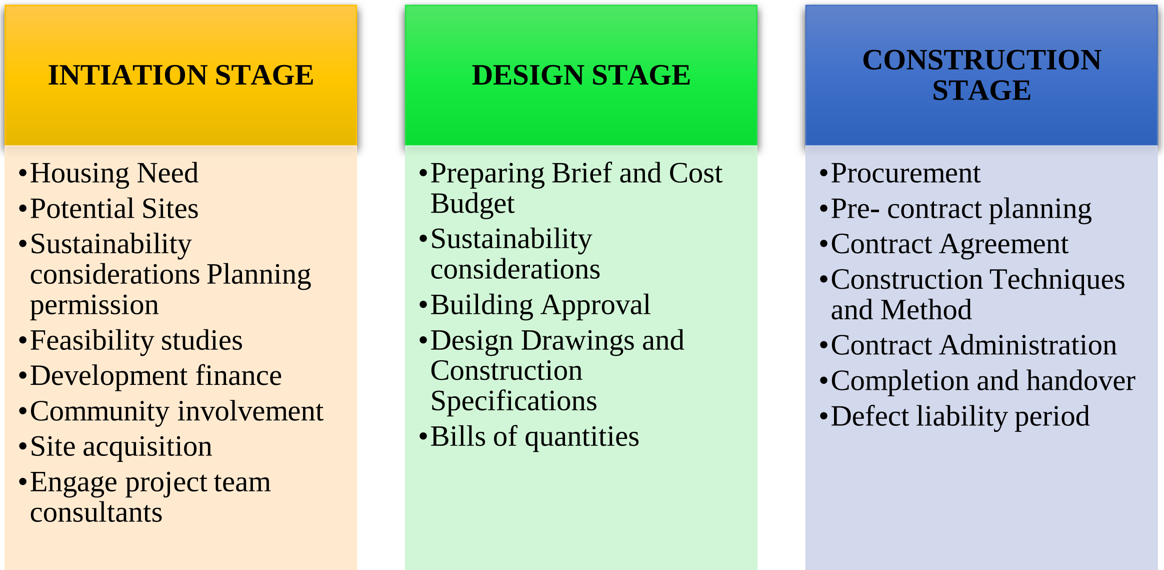


Figure 2. 8: Essentials in Low-cost housing project delivery

Source: Harris and Matthews (2009)

Though the RIBA plan of work is developed for use in the UK construction industry, many countries across the globe adopted this plan for project delivery. Nigeria is one of the many countries that has adapted the RIBA plan of work for building project delivery. Though the RIBA plan of work has just been changed, the old version is no different from the plan of work developed by the Nigerian Institute of Architects (NIA) and Architects Registration Council of Nigeria (ARCON). The NIA plan of work comprises of five main stages; Pre-design (Design 1), Design II, Tendering and award Construction, Post construction. The critical operations at each stage of the process are documented in Table 2.6. This NIA plan is employed for various building projects including LcH project delivery in Nigeria. Whereas the RIBA evolved following need for cost optimization, sustainability considerations and construction environment requirements, the NIA plan of work has made no significant changes despite the contemporary changes in its construction environment.

Table 2. 6: NIA building project delivery plan of work

Stages	**Summary of work**	**Description of work**
Pre-design (Design 1)	Briefing Outline proposal	Identification and outlining client's needs and objectives Develop client and project brief, Site investigations, feasibility studies to view alternative design solutions, procedures and identify project team structure Development of the strategic brief into a full project brief; preparation of outline proposals and preliminary cost estimate/plan; and review procurement route
Design II	Schematic Design Detailed design Production Information	Develop schematic design, review outline specifications and cost plan. Completion of Project Brief and obtain planning permission. Develop detailed design, specifications, and information for statutory standards and construction safety. Preparation of production information needed for building contract and submission of tender documents for approval and as per agreed project programmes Application for statutory approvals.
Tendering and award	Tender documentation and action	Commencement of tender process to the award of the contract.
Construction	Construction Planning supervision and practical completion	Letting the building contract, appointing the contractor, Issuing of information to the contractor, review of information provided by contractors and specialists and hand over site to the contractor. Administration of the building contract to Practical Completion.
Post construction	Post practical completion	Defect Liability period making final inspections for settling the final account

Source: Compiled from Akinde (2012) and NIA/ARCON (2011)

Achieving effective performances at each stage of the project delivery process, require the consideration of certain essential requirements. Takim and Akintoye (2002) identified these requirements to be the quality of managerial, financial, technical and organisational system efficiency. This considerations are also essential in LcH project delivery and cover the procurement procedure/ system, the project team, and managerial system employed.

2.5.3.1 Procurement system for LcH project delivery

Evidence reveals that the sequence of the stages in project delivery may vary or overlap depending on the procurement system adopted. A procurement system is the type of contractual strategy adopted to deliver the project. Some of the commonly identified systems from literature include traditional procurement system, management procurement system, and integrated procurement systems. Examples of which includes design, build, design bid-build, management contracting, etc. (Memon et al., 2014). The adoption of these systems in LcH project delivery may vary from one state, zone or country. Evidence suggests that the traditional and the design and build systems are the common procurement systems mainly adopted for LcH projects (Babatunde et al., 2010; Dada, 2012; Idiake et al., 2015; Obi et al., 2015). The advantages and disadvantages associated with each procurement system is a guide for project sponsors for successful LcH project delivery. However, LcH project success is not limited to the choice of procurement system alone but consideration of other pivot factors such as the quality of the project team and the management system employed.

2.5.3.2 Project Team in LcH project delivery

Apparently, LcH project delivery is a complex process and involves many different stakeholders from both the private and public sector from the government, financial institutions, and builders of housing (Sweeney-Bindels, 2011) with government as one of its major sponsor (Akinde, 2012; Bach, et al., 2007). According to Newton (2015), a project team refers to those people doing the actual work of the project. This team is comprised of individuals from different groups with knowledge of a specific subject matter or with a specific skill set who carry out the work of the project. A project team is comprised of the project manager, project management team, and other team members. Figure 2.9 illustrates the relationship between the project, project stakeholders and the project team. From the diagram the project affects the stakeholders' but the project team and sponsor have a direct input into the project performance. Therefore, the performance of the project team have a significant impact on the success of the project. From the diagram the project team constitute the project sponsor (who has an overlapping function), the project management team (PMT), the project manager and other members of the project team.

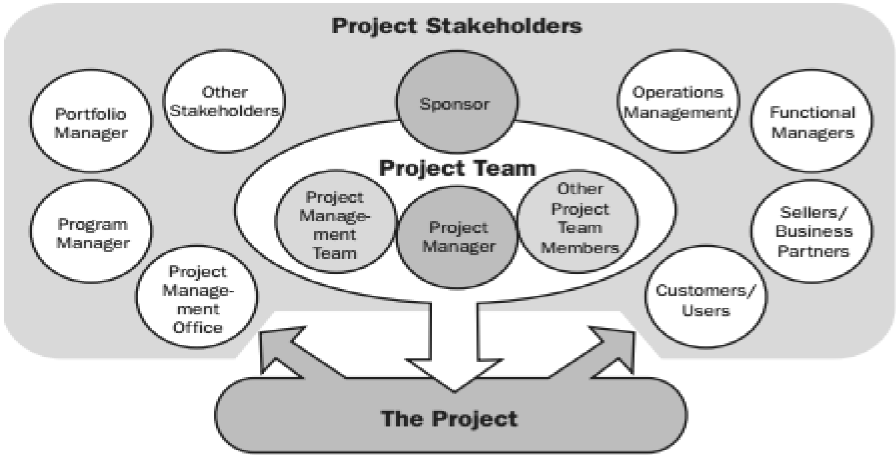


Figure 2. 9: Project, project stakeholders and project team

Source: PMI (2008)

The roles of the project team members as discussed as follows.

- *Project Manager:* This professional is the person assigned by the project sponsor to achieve the project objectives. The project manager is the person or professional responsible for communicating with all stakeholders, particularly the project sponsor, the project management team, and other key stakeholders (PMI, 2008, p. 26). The primary stakeholders in this context are the subset of stakeholders, who if their support were to be withdrawn in the management of the project would cause the project to fail. The project manager is appointed before any of the consultants to assist with the appointment of the rest of the management team, acting as the interface between the consultant and the client and provide assistance in managing all the other key actions required to deliver the project, from predesign to construction.
- *Project Management Team (PMT):* This team is comprised of a set of professionals/ organisations directly involved in the management (cost, time, and quality) of the project. They are directly involved in project management activities. They include the project manager, consultants, and the main contractor. The PMT, Iroegbu (2006 cited in Ogbu & Adindu 2012) identified the PMT is comprised of a category of staff from state ministries, departments and agencies of government concerned with the housing project management and the private sector consultants and contractors engaged towards successful project delivery.

- *Other project team members:* These are all the other members who carry out the work on the project, but not necessarily directly involved with the management role on the project. They include skilled and unskilled labour, subcontractors, suppliers and service providers, etc.

In the Nigerian context, Ogbu and Adindu (2012) identified LcH project stakeholders as private and public sector stakeholders. They espoused that the public sector includes the project sponsors (government housing ministries, parastatals, agencies, and departments while the private sector stakeholders include contractors and consultants engaged by these project sponsors. The key stakeholders responsible for project management activities is the PMT. This team has a key managerial influence on the decisions affecting the project cost, time, and quality. It constitutes three sub-teams whose members are construction professionals such as architect, service (mechanical and electrical) and structural engineers, quantity surveyors and the builders' construction managers. The three sub-teams include:

- *Housing agency supervisory team (HAST):* This team includes the project manager and project supervisors. The HAST is the management and supervision team from the FHA or SHC project department. This team constitutes the project manager and other selected construction professional from the housing agency's project department. The project manager heads the in-house supervisory team from the SHC or FHA responsible for directing other members of the project team, managing the project plan and reporting progress to their organisations to ensure that the project success. Other members of the PMT ensure that the decisions of the Project Manager are executed on site and make their site reports.
- *Consultancy team:* This team constitutes the private consultancy Architectural, Engineering and Quantity surveying construction firms. The agency engages them to undertake the responsibility for the planning, design, and supervision of the project and contractor.
- *Contractor's management team:* This team constitutes the site managers and supervisors of the contracting construction firms. They are engaged by the agency to undertake the responsibility of completing a building project by the contract documents on behalf of the client and carry out all operations on site, including supervision of the works by sub- contractors.

The decisions of these key stakeholders on the LcH project could stimulate or militate effective delivery. Hence, their actions require considerable attention in management.

According to Anyanwu (2013), a study on the role of PMT in public project delivery, found that the HAST members are either architects or engineers. However, a builder, architect, quantity surveyor or engineer can act in this role. Nwanekezie (2006 cited in Ogbu &Adindu, 2012) further expressed concerns that some of the professionals from the consultancy and contracting organisations employed to manage LcH projects do not usually have adequate skills and competence to effectively initiate, develop, and monitor the progress of housing projects. In their view, the effects are evident on the poor performance of the projects. Therefore, the quality of their expertise will influence the implementation of the management system adopted in LcH project delivery.

2.5.3.3 Management systems for LcH project delivery

A system on the other hand according to Checkland (1981) is a set of distinct elements linked together to form a whole, showing, in the process, properties of the whole instead of properties of its parts. According to Kast and Rosenzweig (1985), a system is an organized unitary whole composed of two or more interdependent parts, component, or subsystem and defined by identifiable boundaries from its environmental supra-system. Espejo (1994) described a system as a way of view from a particular set of interrelated subsets to the whole. On the other hand, management is employing human effort (people) and techniques towards realising specific objectives on a project (Kast & Rosenzweig, 1985). According to Dessler et al. (2004), it is the act of planning, organising, leading and controlling resources to meet organisational objectives. Jaggar et al. (2002) in construction terms defined management as the responsibility for ensuring that the functions of planning, control, and feedback are successfully brought together in terms design, cost, time and quality. Therefore, a management system is an organized unitary whole with interdependent components synchronising knowledge and techniques to ensure that resources for various processes involving activities are planned, organised, and controlled effectively to realise set project objectives.

In managing a project successfully, the PMI (2008) in its PMBOK identifies nine systems that facilitate management designs and maintain an environment in which collaboration is initiated towards for effective project management and accomplishment of selected project objectives (Figure 2.10). Each system contribute significantly towards project management success. Hence ensuring effective performance of each system in the various knowledge areas is highly relevant.

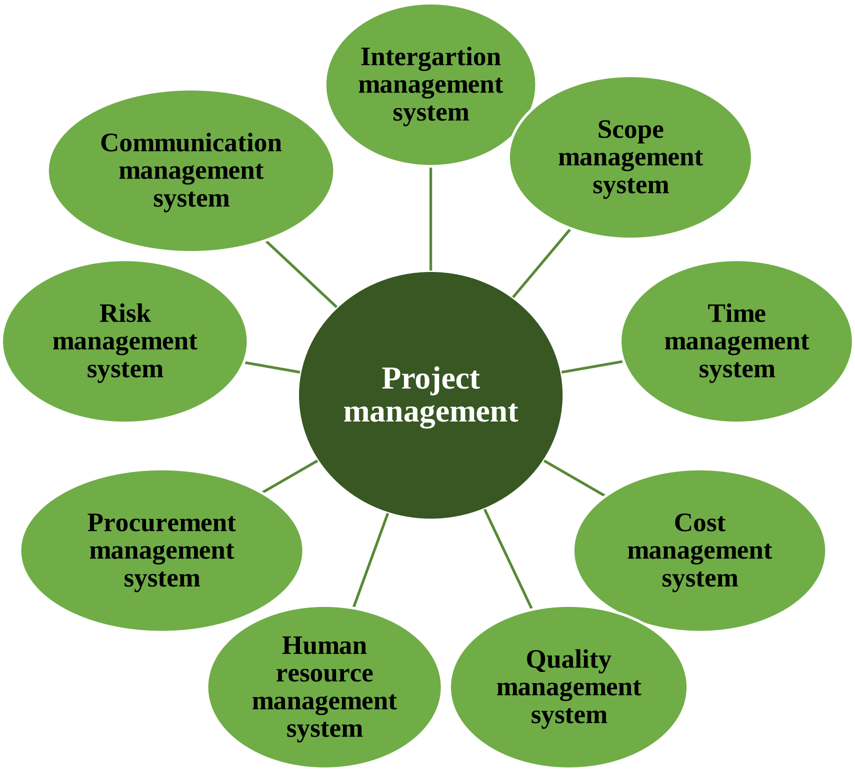


Figure 2. 10: Systems for effective project management

Source: Adapted from PMI (2008)

Achieving effective performance in each is dependent on the adequacy of the system employed. Therefore, the success of the project management is reliant on the effective outcome of each of these systems. All the systems have a degree of influence, as the input of one system is the output from the other. However, the prioritised criteria measuring the success of the project from the view of the client emphasizes those critical areas for enhanced performance.

2.5.4 Success Criteria in Low-cost Housing Project delivery

The subject of project success is at the heart of project management, and it is not surprising that the topic has interested academics and practitioners for decades and continues to be of relevance (Muller & Judgev, 2012). De Wit (1988) considers a project successful if the project meets the technical performance specification and mission specified and satisfies the project sponsors, project team and end users of the project. The Project Management Institute (PMI) (2008) described project success as meeting or exceeding stakeholder needs and expectations from a project that invariably involves placing consideration on cost, time, and quality as the core criteria for project success. Project success is meeting the criteria identified and agreed at the start of the project to the best satisfaction of the client (Association of Project Management (APM) body of knowledge, (2006). Apparently, Cleland (1986 cited in Prabhakar, et al., 2008), espoused that the definition of project success is quite ambiguous except considered from two vantage points: the degree to which the project's technical performance objective was attained and the contribution that the project made to the strategic mission of the enterprise. However, certain elements are salient: performance and satisfaction.

Literature documents various criteria to measure project success. For instance, Bryde and Brown (2004) some stakeholders judge project success based on performances, while Muller and Turner (2007) judge project success based on the fulfillment of personal objectives. In a study by Reiss (1993), project success from a client's perspective is based on effective cost and time performances, as are key criteria whereas from contractor's perspective profit margins and turnover is key criteria. Liu and Walker (1998) identified functionality/quality/technical specification, safety and environmental sustainability and the satisfaction of the claimant(s) as key criteria to measure project success. According to Koushki et al. (2005), time, cost and quality performance are key criteria in addition to contractor's profitability, the absence of claims and court proceeding and service performance for occupiers. Mollaoglu-Korkmaz et al. (2011) described some subjective criteria such as – operability, functionality, reliability and long-term gains. A critical examination of several studies on project success particularly from the client and the PMT perspectives shows a consensus on four main criteria that defines successful project delivery-effective cost, time, quality, and service performance.

However, some scholars such as Prabhakar (2008) and Baccarini (1999), associates cost, time, and quality performance with project management success. Views by Nkado et al (2001), are on the contrary. They synchronized successful project delivery with project management success and client satisfaction (Table 2.7) and established that cost, time, quality performance and service attitude are key criteria at the project delivery phase. Hence, it is deduced that the non-attainment of these criteria at the project delivery can result in client dissatisfaction or project failure.

Table 2. 7: Synchronising project success and client satisfaction

Stage	Operating satisfaction component	Satisfaction Criteria
Project delivery	Design, costing, management and construction	Cost performance Time performance Quality performance Service attitude
Project Operation	Building features/in-use performance	User requirements functional performance Market attractiveness

Source: Adapted from Nkado et al (2001)

Similar studies in the context of LcH project delivery by Ahadzie, (2010) and Adinyira et al. (2012) show 15 success criteria associated with project delivery and project operation stages. (Figure 2.11). Findings from their investigations show that cost of individual units and overall cost performance ranked the most important success criteria followed by quality and time performances. They prioritised effective project cost, time and quality performance as key success criteria in LcH project delivery.

Evidence from studies (Ogbu & Adindu, 2012; Abimaje & Akingbohungbe, 2013; Makinde 2014; Amade, et al., 2015; Obi & Arif 2015) on public sector housing projects delivery in Nigerian reveal similar findings. They all highlight effective cost and quality performances as key criteria for measuring project success. Similarly, this view is emphasised in the NHP aim "*To ensure that all Nigerian own or have access to decent, safe, and sanitary housing in a healthy environment with infrastructural services at affordable cost*…" (FMLHUD, 2012, p. 2). Furthermore, a report by the former Coordinating Minister for the Economy and Hon. Minister of Finance Okonjo-Iweala, in the 6th Global Housing Finance Conference World Bank Headquarters, Washington, DC in 2014 buttress these criteria. According to her, to achieve successful LcH project delivery is to promote good quality and efficient houses at reduced costs, which is essential to address the current LcH supply-side concerns. Furthermore, the vision 2020 proposes massive LcH developments across the country estimated at 157 billion naira at an estimate of 3.5 million Naira per 2-3 bedroom (FMLHUD, 2012). This budget per unit is stringent emphasising the need for viable strategies to deliver effective project cost performance.

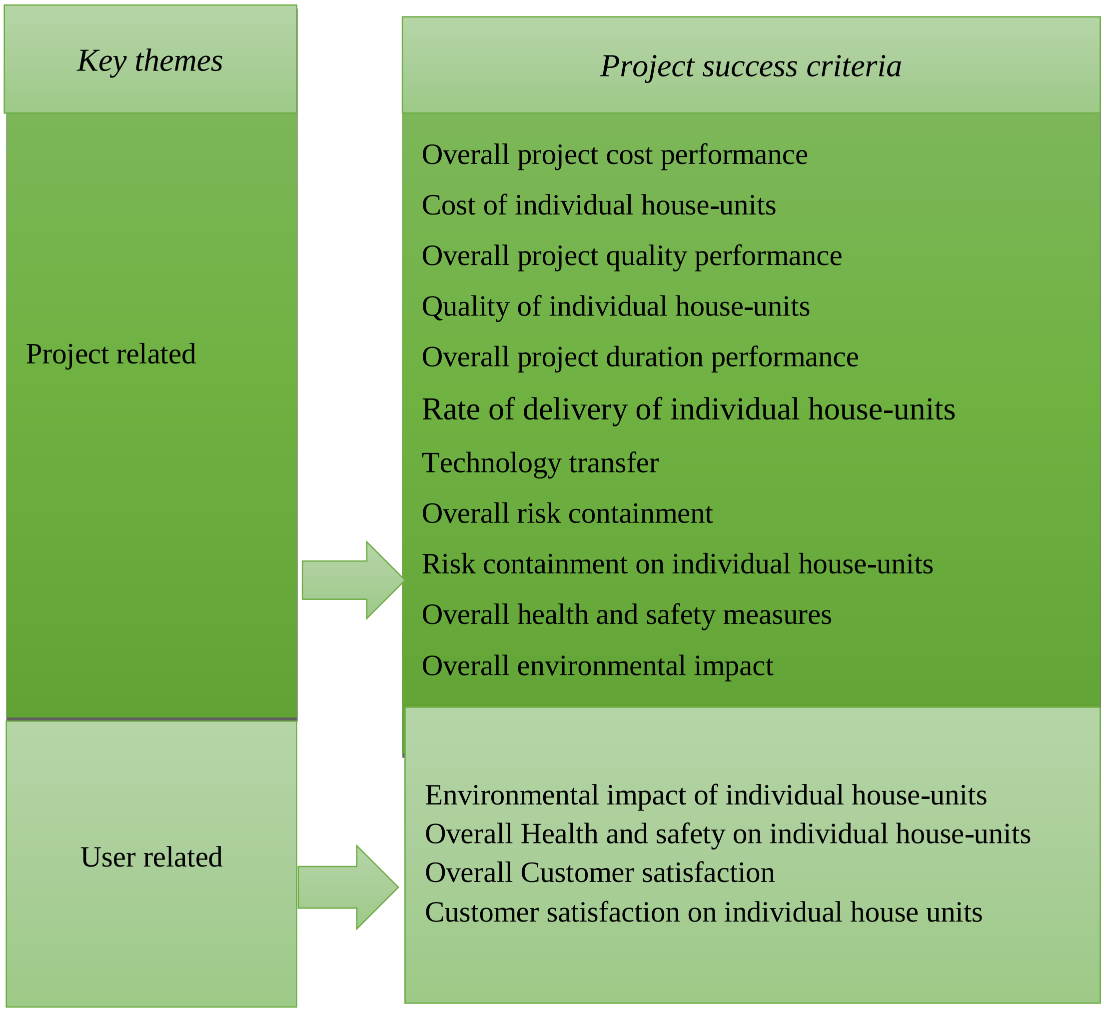


Figure 2. 11: LcH Project success criteria

Source: Adapted from Ahadzie, et al. (2008)

From the above review effective cost, quality and time performances are key success criteria for successful LcH project delivery. However, the prioritization of the criteria may vary from one client to another and across varying countries context as in the case of Ghana and Nigeria where cost and quality are highly prioritised. Given that the client is one of the main reason for the project existence (Wateridge, 1998, cited in Westerveld, 2003), the priority of the PMT should align with the criteria highlighted by the client to measure the success. This study is situated in their view where achieving effective cost performances is a key success criterion for the project delivery phase that cumulatively sums up to the overall project success. Therefore, the PMT is expected to employ effective strategies to ensure that the set project success criteria and satisfaction of the client are achieved.

The next section discusses the concept of cost performances as one of the prioritised criterion defining LcH project success. This review aims to give a clearer understanding of project cost performance as used in this context.

2.6 PROJECT COST PERFORMANCE

Performance is the degree of achievement of an undertaking that relates to the prescribed objectives that constitute the project parameter (Chitkara, 2010) in terms of time, quality and cost. Project cost performance is unquestionably the most significant concern to contractors, consultants, and clients alike (Memon, et al., 2014; Xiao & Proverbs, 2002). This section reviews the literature narratively on the concept of project cost performance from both global and Nigerian perspectives. It starts by defining project cost and then proceeds to identify the factors driving poor cost performances.

2.6.1 Definition of Project Cost

Cost is defined as a measure of the acquisition or consumption of a scarce or constrained resource to achieve a specific outcome (Hilton et al., 2000, cited in Tang, 2005). There are various types of cost. Project cost is one type of cost defined by purpose characteristics. However defining project cost could be ambiguous when not used in context. Recommendations by Crossett and Hines (2007), is to clearly define project cost as used in the context being investigated. Therefore, in an attempt to understand project cost performance, an operational definition of the term project cost as used in this regard is needful.

A project cost is identified as a significant portion of the LcH provision costs both in international studies (Wang & Zhang, 2014; Massyn, 2015) and within the Nigerian context (Ogu, 1996; Ugonabo & Emoh, 2013). Project cost has been defined in various ways across literature and reports. According to Jaggar et al. (2002), a project cost is the “amount” of money the client spend or hand over to the builder, usually during and on completion of the building project. Similarly, Krikham (2007) defined project cost as the amount of money the client expects to pay to the developer/ builder during and on completion of the building project. (Where a builder/ developer in this context refers to a person and or an organisation with the expertise need to perform any given aspect of work towards the realisation of the project). It is the total amount of money the client spends directly or indirectly in the design and construction of a building project (Schram, 2012). However, Ashworth (2010) from another perspective defined project cost as the total "amount" of resources regarding "money" spent by the client in the delivery of the project from initiation to demolition. However in a recent report by the American Institute of Architects (AIA) (2016) project cost is defined as the total funds budgeted for the project, including construction cost, design fees, furnishings and equipment, fees and permits, and contingencies.

It is observed that there is ambiguity surrounding the definition of project cost. While some have described it as construction cost, or cost of design and construction, others have espoused it includes the cost of maintenance and demolition. However, drawing from earlier discuss project cost should be associated with project delivery phase, which is design and construction related. Therefore, Project cost as used in this context connote the funds set out or spent by the client for the design and construction of the project. Therefore, it is the total cost that the project sponsor (housing agency) expects to pay or pays for the design and construction of the LcH project. These include design cost and construction cost paid to consultants and contractors.

Design costs constitute the cost of professional fees. These professional fees include the cost of project designs and supervision (contract administration cost) incurred during the predesign, design and construction stages (Venkataraman & Pinto, 2008; Ashworth, 2010). It involves the cost expended on professional fees, the preparation and production project designs, specifications, reports, and documentation as well supervision (contract administration cost) incurred by the project consultants during the predesign, design and construction stages. The construction costs include the cost of labour, material, plant, overheads of the contractor/ subcontractor. Based on the understanding of project cost defined above, the term project cost performance can be defined with better clarity.

2.6.2 Definition of Project Cost Performance

Project cost performance is the degree to which the actual project cost equates the initial project cost estimate or budget (Avotos, 1983, cited in Arcila, 2012). Cost performance is measured in terms of percentage cost overrun experienced on a project. To measure this cost overrun some authors consider that the initial project cost estimate is the target cost determined at the beginning of the project when the decision of commencing the project is made (Flyvbjerg et al., 2002). On the other hand, other authors uphold the idea that project cost performance should be defined by comparing the original contract value with the final cost of the project at the time of completion. The difference between is reflected in the measure of the magnitude of project cost performance (Love et al., 2012). Arcila, (2012) describes project cost performance as comparing the final project costs with the initial cost budget. Based on this school of thought, project cost performance is determined by comparing initial target project cost at the predesign stage with the final project cost incurred at the end of the construction stage.

Ashworth (2010) defines project cost performance from perspectives of effectiveness or efficiency. Regarding effectiveness, he stated that it is the achievement of project cost not exceeding initial cost target and efficiency lower than initial cost target but with improved quality. However, this study has the view that the two terms aim to satisfy client expectations within the target budget without compromising quality standards. Since a client's decision to build is premised on fulfilling certain requirements within a budget frame, then achieving such objective within the budget is an effective performance. Therefore, LcH project delivery within initial target cost indicates effective performance and exceeding that cost indicates poor cost performance.

2.6.3 Review of Project Cost Performances

Effective project cost performance is considered a driving force of project success (Odediran & Windapo, 2014) and unquestionably the most important concern to the project team on any construction project (Xiao & Proverbs, 2002; Memon, et al., 2014). However, evidence from several studies on construction related projects including LcH projects shows high occurrences of poor cost performances which are a problem continuously attracting serious attention over the decades. For example, an earlier study by Morris and Hough (1983, cited in Oladirin et al., 2013), on this issue discovered that more than 4000 projects executed in various countries across the globe experienced poor cost performances. Flyvbjerg, et al. (2002) also stated that the average poor cost performances experienced on construction projects in Europe were 25.7 percent, North America 23.6 percent and 64.6 percent overrun in other geographical areas.

In the United Kingdom, nearly one-third of the clients complain about this issue on their projects (Jackson, 2002). An investigation on cost performance in the UK construction projects found that 26 of 103 projects covered experienced poor cost performances. He also examined four construction projects in the USA and similarly, all experienced poor cost performances in the range of 12.3 to 15.3 percent overrun. In Germany, Kostka and Anzinger (2015) found that poor cost performances are in the average of 63 percent cost overrun. While in Australia a study by Terrill et al. (2016) on transport infrastructural project found that poor cost performances are in the average of 25-40 percent cost overruns. However, findings on poor project cost performances appear to be more severe in developing countries.

A study by Angelo and Reina (2002) points out that poor project cost performances in developing countries sometimes exceed 100 percent overrun. Nicco-Annan, (2006) confirmed this in a study of building projects in Ghana where poor project cost performances ranged from 60 to 180 percent cost overrun on the average without considering inflation. Ameh et al. (2010) also found that the 63 percent of 1778 construction projects financed by the World Bank experienced an average of 40 percent cost overrun. In Malaysia, Memon et al. (2012) in a study showed that 96 percent of the large construction projects in Malaysia experienced. The findings of the above studies, poor cost performances is an issue affecting the construction industry in both developed and developing countries and has become a norm.

Similar findings are found in the context of the Nigerian construction industry. Studies by Omoregie and Radford (2006), Eshofonie, (2008), Kasimu, (2012) and Odediran and Windapo (2014) affirm that many projects in Nigeria experience poor cost performances. A study by Akinde (2012) further posited that poor cost performances could range between to 100 percent cost overruns on LcH projects. In the case of Nigeria, this issue is apparently affecting the production output of the construction and housing sector in Nigeria and particularly in LcH project delivery. The rising trend of the poor cost performances of LcH projects in Nigeria since post- independence has triggered serious concerns by public sector clients (FMLHUD, 2012). Many project sponsors (public and private), have consequently complained about the effect the additional cost on the project exert on their investments and objectives. On the other hand, projected beneficiaries are faced with transfer higher occupancy costs, and the reputation of the consultants undermined for not being able to deliver value for money to the client (Akinde, 2012; Ubani et al., 2013; Obi et al. 2015).

Consequently addressing this problem have formed the centre of debates in housing literature across the globe and particularly in a developing country like Nigeria.

Based on this discovery, it is the stance of this research that effective avenues to addressing this problem need to be examined. One of the step in this direction is to identify the possible driving factors.

2.6.3.1 Factors causing poor project cost performances

A plethora of factors has been identified causing poor project cost performance in both developed and developing countries. More specific to housing projects, Koushki et al. (2005) in a study in Kuwait, identified six main factors relating to the contractor- problems, owners' inexperience in construction, material, weather, labour-related, and variation orders (change orders) affected project cost performance. Durdyev et al. (2012) in a study of housing project delivery in Turkey, identified improper planning, inaccurate project estimation, the high cost of need resources, lack of skilled workforce, the price of construction materials and the high cost of land were most significant barriers affecting project cost performances on housing projects. Other barriers were the lack of coordination, cost of rework, short duration of the contract period, lack of communication between parties, and poor on-site management. However, they concluded that the identified barriers mainly originate from poor resource management systems. This finding was similar to those in a recent study by Memon et al. (2014) on Majlis Amanah Rakyat (MARA) construction projects that also include LcH projects.

Similarly, in the Nigerian context, Chimwaso (2000) identified design changes; inadequate planning; unpredictable weather conditions; and fluctuations in the cost of building materials as some of the most significant barriers to effective project cost performance. While other studies (Ogbu & Adindu, 2012; Akinde, 2012; Amade, et al., 2015; Obi et al., 2015; Okoye et al., 2015) identified are poor design, poor resource management, poor technology, ineffective financing methods and payments for completed works, poor contract management, ineffective cost management systems, poor planning and supervision as more specific to LcH project delivery. Many of the factors identified appear to be technical (project characteristics, and constructability) and management (team competency and management system) related with the latter more emphasised.

Accordingly, Charoenngam and Sriprasert (2001) emphasised that management related factors have a higher influence on performance outcomes. They concluded from their study that poorly established project cost management systems are significant to poor project cost performances. Later studies by McManus and Wood-Harper, (2007) on causes of poor cost performances also highlighted poor CMS as one major management related factor that contributes to poor cost performances and in some cases accounts for up to 65 percent impact. Corroboratively, Otunola (2008) also found ineffective CMS at the pre-contract and post-contract stages of the project significant contributory factors of poor project cost performances in Nigeria. In the Nigerian housing project context, Okoye et al. (2015) identified that poor cost performances primarily result from cost management challenges. This finding was in consensus with findings by Obi and Arif (2015), in a study of LcH project cost performances in Nigeria emphasising that the CMS employed is a significant cost management barrier.

The findings from these studies reviewed indicate that poor cost management challenges and especially ineffective CMS have a major influence on poor project cost performances. In other words, an effective system will result in an effective cost performance and vice versa. Based on this discovery, it is clear that the CMS can have a considerable impact on expected project cost performance. Therefore understanding what constitute an effective CMS will facilitate the development of an appropriate system model that can be widely adopted to manage project cost in LcH project delivery in Nigeria.

2.7 CONCEPT OF PROJECT COST MANAGEMENT SYSTEMS

This section systematically discusses the literature on the characteristics of a CMS. It starts by defining project cost management and CMS and then proceeds to identify the techniques and process of a CMS as well as various CMS models for LcH project delivery.

2.7.1 Definition and Need for Project Cost Management

Management from a project perspective involves the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements (PMI, 2015). It is the means for coordinating the process of design and construction (planning, staffing, organizing, budgeting, scheduling, and monitoring). Management is therefore, input, which is, desired to produce an output (performance) that is expected to be effective and satisfying. Project cost management as defined by Tanaka et al. (1993) I s the process that involves initiating and making decisions that will improve the cost-effectiveness of an organisation by understanding the concepts of cost discussed above within the context of their own business. It is fundamental to staying competitive in the construction industry and is defined as the process of planning, estimating, coordination, control, and reporting of all cost- related aspects of a project to ensure project completion within the approved budget (Kern & Formoso, 2006; Ashworth, 2010). Therefore, project cost management is not about cost reporting, accounting or maintaining records of expenditure, but understanding what activities and associated cost will be incurred; why, how, and taking appropriate proactive actions in light of all the relevant related information. Hence, involves identifying all the costs associated with the various elements and activities in the project from predesign to design and the construction stages and managing those costs to ensure cost effective performance and achieve the maximum amount of work at a specified level of quality.

From the above definitions, project cost management as used in this study is the process of adequate planning, estimating, budgeting, monitoring and controlling project expenses in an appropriate and sequential manner to achieve effective cost performances.

Effective project cost management is of great importance in project delivery because it is concerned with the management of cost related activities, which is a needed input to achieve the general goal of project management (PMI, 2008). According to Seeley (1996), effective project cost management helps the PMT:

- To provide the project clients with a built facility that offers value for money
- To set effective cost targets of the building's elements
- To assure that the project cost does not exceed the client's budget.

Other benefits identified from studies (Akintoye 1998; Tang, 2005; Smith, 2014; Gopalan et al., 2015) are as follows:

- Cost/ time reduction
- Process and product improvement
- Forecast and control of resources

- Value for money
- Balanced distribution of expenditure
- Competitive advantage
- Budget finance evaluation
- Improved decision making
- Cost performance
- Customer satisfaction
- Quality control
- Information generated to support design and construction process
- Increased cost transparency

As a result, of these well-voiced benefits, many private and public sector clients are recognising and emphasising the need to employ appropriate strategies that can facilitate effective cost management in housing project delivery.

Some public sector clients in countries like the United Kingdom have already developed comprehensive cost management frameworks to guide organisations involved in public sector projects to achieve effective project cost management and performance (United Kingdom office of government commerce, 2007). Though such guides may not widely found in many developing countries, no doubt, many housing agencies and ministries are unrelenting to develop similar contextual and appropriate guidelines.

2.7.1.1 Need for project cost management in LcH project delivery

Like other construction projects, effective cost management is more expedient in LcH project delivery. The results of poor project cost performances on LcH project delivery are seen to affect production output and undermine affordability of projected target beneficiaries giving room for growing rates of slums and other makeshift accommodations. Consequently, studies by Granja and Jacomit (2011) and Obi and Arif (2015) have established the peculiar need for effective cost management in LcH project delivery, especially for developing countries. These projects are characterised influenced myriad funding sources, high procurement route, location design considerations, affordability and high demand by target beneficiaries and mass development competing for scarce resources to mention a few. Unlike other projects, the venture into LcH projects and schemes are not for investment purposes but to meet housing need of a particular set of the population group. Therefore, the consideration of production cost, price, and affordability of projected beneficiaries are paramount and rigid.

The considerations in LcH provision reflect in the project budget allocated and is determined from available government expenditures funds and affordability requirement of projected beneficiaries (Granja & Jacomit, 2011). Hence, resources are more rigid in LcH projects unlike in another type of projects requiring cost optimisation. One would expect that given the rigidity in the fix budget considerations on cost management is often undermined and taken for granted by the project team leading to poor cost performances. In many cases, the ineffective approaches employed to identify, managing and controlling project cost within client budget is one main challenge to effective cost management on these projects (Granja & Jacomit, 2011; Ogbu & Adindu, 2012; Obi & Arif, 2015). Because of the large and prototype nature of the projects designs and management system are usually same. Therefore any error in estimating or planning do not just affect the cost of one unit but the entire scheme which can consist of thousands of units. For this reason, the issue of effective project cost management is an essential.

Furthermore, given the Global Financial Crisis since 2008 that have significantly impacted on project financing around the world, many of these financiers have tighten lending controls and avoid lending for projects lacking sufficient risk controls (Smith, 2014). These controls have made public sector clients, major private sector financiers and global entities such as the United Nations, and the World Bank demand is increasing attention for effective cost control on construction projects and especially LcH projects developing countries (Smith, 2014). Therefore effective systems for project cost management that can facilitate cost optimisation in LcH project delivery while maintaining acceptable levels of quality and satisfaction need to be employed.

2.7.2 Definition and Overview of Project Cost Management System (CMS)

Achieving effective project cost management is not a simple process (Knipe et al., 2002) but involves the proper consideration of the choice techniques the process and how effectively they are implemented is necessary to produce exceptional outcomes. However, there is a systematic way in which the techniques and process need to relate to eventual successful outcome. This structure can be referred to as the project cost management system.

A CMS is a management system constituting a set of techniques and process stages required to ensuring accurate estimation, planning monitoring and control of project cost to ensure project completion within the approved budget (Kern & Formoso 2004). It is, viewed as a framework for a set of principles, methods, and tools whose main objectives are to estimate costs and to generate cost information to support different managerial decisions during the distinct phases of a project (Horngren, et al., 1997; Berliner & Brimson, 1998). In another definition, it is a structure that works out a plan to ensuring that it the final project cost is completed within the predetermined tender price while maintaining a good quality of the product (Al-Jibouri, 2003). All these definitions suggest the CMS as a framework or structure that synchronises the interrelationship between the techniques and the process to produce an effective management performance outcome. Therefore, in a proper definition, CMS, as used in this context, is the structural framework consisting of a set of techniques and processes needed to adequately set, plan, estimate, monitor, and control project cost towards achieving effective cost performance outcomes.

According to Kern and Formoso (2004) and Jacomit, and Granja (2011) an effective CMS facilitates information to support decision-making, stimulate cost reduction, value improvement, and provide continuous improvement in the organization. The Association for Project Management (APM), UK, has stated that an effective CMS should be able to provide a managerial overview of cost implications of decisions throughout the project delivery process, particularly at the early stages and be able to draw the project management's attention to problem areas. An input- process- output (IPO) view of management systems show a structure composed of interdependent and interrelated elements or parameters. Sanvido 1988 and Windapo, (2013) describe the parameters as input, process and output parameters. In their view, the input parameter embodies the techniques, tools or resources that feed into the process parameter. The process uses the input to produce an output that can be viewed, stored, planned and monitored. The output parameter is the eventual outcome of the system. Besides, they acknowledged that there are conditions upon which the viable system implementation rely. Windapo (2013) recognise these conditions as a loop parameter while Sanvido (1988), refer to it as the control parameter. In his view, this parameter embodies factors necessary to regulate and moderate activities, provide the feedback needed for operations in the input, and process parameter. Relating their view in the context of CMS is as depicted in Figure 2.12. The input parameter embodies the techniques, while the control parameter embody factors responsible for successful regulation of the choice of techniques, and process implementation as well as providing feedback necessary to examine the output of each process stage against certain predetermined performance pointers.

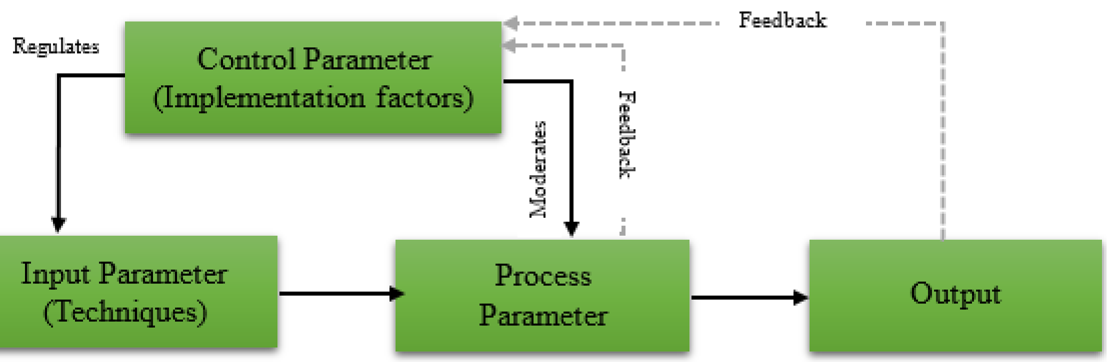


Figure 2. 12: Process view of a cost management system

Source: Adapted from Sanvido (1988) and Windapo (2013)

The next sections examine the characteristics of CMS.

2.7.3 Project Cost Management Techniques

The input parameter of the CMS embodies a set of techniques. In this study, this parameter represents the technical components of the CMS. Various cost management techniques are found in literature (Tang 2005; Kern & Formoso, 2006; Ballard, 2008; Sanni & Duruola, 2010; Azis et al. 2012; Chigara, et al., 2013; Obi & Arif, 2015). However, the commonly cited ones generally and specific to LcH project delivery include: cost planning, cost estimating, cash flow analysis, cost reporting, onsite project resource control, value engineering, target value design, target costing, activity based costing and earned value analysis. All the techniques are effective when used at the appropriate process stages. The literature supporting these ten techniques identified are as discussed.

2.7.3.1 Cost planning technique (CP)

Cost planning is a budget distribution technique that that involves a critical breakdown of the cost limit (i.e. the employer's authorized budget) for the building(s) into cost targets for each element of the building(s). This technique is implemented during the design stage and allows planning, comparing, checking, reconciling, and monitoring costs from the feasibility stage to design (PMI, 2008; Iroegbu et al., 2010; Aziz et al., 2012). It ensures that:

- clients are provided with value for money;
- designers are aware of the cost consequences of their desires and proposals;
- provide advice to designers that enable them to arrive at practical and balanced designs within budget;
- keep expenditure within the cost limit approved by the employer; and
- Provide robust cost information upon which the employer can make informed decisions (Royal Institute of Chartered Surveyors (RICS), 2012).

According to Sc quantity surveyors (2015) and Jaggar et al. (2002) cost planning allows:

- Establishment of a preliminary approximate estimate
- Planning how this estimate should be spent on the various parts or elements of the project
- Checks to ensure that the actual design details for the various elements can be constructed within the cost plan.

2.7.3.2 Cost estimating technique (CE)

"Cost estimating is employed as one of the main tools of successful cost management" used to prepare cost estimates (design, bid, or control), as may be required (Oyedele, 2015). Such budgets become the benchmark upon which project cost performance will be monitored and controlled (Chigara et al., 2013). Thus, the estimate and budget form the entry point to cost control. The cost estimating technique assists to ascertain the estimated cost of project resources to be expended on the project, and the production of the elemental bills of quantity necessary for tender documentation (Kern & Formoso, 2006; Aziz et al., 2012). Cost estimating technique adopts the following approaches:

- Bottom-up estimating: developing estimates from working drawings and specifications
- Analogous Estimating – using expert judgment and historical data to develop cost estimates adjusting for known differences (such as size, complexity, scope, duration, etc.)
- Parametric Estimating – using expert judgement and statistical relationship based on cost models such as cost per unit, area or volume of previous similar projects
- Three-point estimating-using three estimates to determine a range for an activity's cost.

2.7.3.3 Cost reports technique (CR):

This technique is effective for recording all the financial transactions, payments in and out, together with amounts owed and owing (Tang, 2005; Aziz et al., 2012). This technique is used throughout the project delivery stages to provide progress information that is used to assess project performance against set targets. Cost reports can also be used as means of cost value reconciliation (Chigara et al., 2013) hence, need to be clearly and often prepared. Cost reporting enables effective monitoring of costs throughout the project delivery process so that where necessary concerns for immediate proactive and remedial actions can be taken based on the information on the reports (Clough et al., 2000). Therefore, the technique assists in reporting cost transactions in the course of project delivery.

2.7.3.4 Cash flow analysis technique (CFA)

Cash flow analysis involves a breakdown of the project budget against the construction Programme of works. A project cash flow documents a complete history of all cash disbursement and all earnings received as a result of project execution at the different levels of construction phase of the project. This technique is popularly used by contractors for construction projects especially in many developing countries (Tang, 2005; Aziz et al., 2012). Cash flow forecasting tries to relate the project's cash flow against the time as reflected in the schedule of activities. In that regard, contractors use the work programmes concurrently with project cash flow to manage and control project costs. This approach allows the contractor to relate project cost performance against project schedule and is mostly employed at the construction stage by many contractors to monitor profitability once the construction project is in progress.

2.7.3.5 Onsite project resource control technique (OSRC):

This is a technique used to control labour, material, and plant on the site (Chigara et al., 2013; Sanni & Duruola, 2012). It involves the how, what, and when to purchase, store materials, engage labour, plant, and equipment utilisation schedules. On site, material registers, plant registers, and labour time cards are used to manage movement of resources and minimize idleness and misuse of resources to avoid waste. The technique help meant to control negative variances.

2.7.3.6 Target costing technique (TC)

Horváth et al. (1993) defined TC as "a comprehensive cost planning, cost management, and cost control concept...used primarily at the early stages of product design to influence product cost structures depending on the market derived requirements. The TC is a "system of profit planning and cost management that is price led, customer focused, design centered, and cross-functional" (Ansari et al., 1997, p. 11 cited in Nicolini, et al., 2000). In effect, TC is a proactive cost planning and cost reduction technique whereby costs and product are planned and managed and early in the design and development cycle, rather than during the latter stages of product development and production. Jacomit and Granja (2011) and Kern and Formoso (2004; 2006) have mainly investigated its possible application and benefits to improve cost performances on Brazilian LcH projects. Studies by Sobotka et al. (2007) and Hanid et al. (2010) have identified the TC as an effective technique for improving CMS performance. The TC process involves

- establishing the target price in the context of market needs and competition,
- establishing the target profit margin,
- determining the target cost that must be achieved. The target cost is determined by deducting the profit margin from the target price.

  Target cost= Target price – Target Profit ….Eqn 1

- calculating the probable cost of current products and processes,

- establishing the cost targets for the elements of the project—the amount by which costs must be reduced.

2.7.3.7 Value engineering technique (VE)

This technique is a modern value driven technique involving the process of selecting the most cost-effective design solution (Kelly & Male, 1993; Cheah & Ting, 2005; Jariri & Zegordi, 2008). It examines at the selection of materials, plant, equipment and processes to see if a more cost-effective solution exists that will achieve the same project objectives. This technique is most employed at the design stage although it could also be used during construction. This technique which plays an important role to ensure that the client and designers consider all value and cost related aspects of the construction, design development, and development options. As identified by Venkataraman and Pinto (2008), the VE process involves:

- Needs Assessment- Understanding the key success criteria
- Idea generation- creative and innovative alternative to complete the project
- Detailed evaluation- evaluate options based on functionality and achievability
- Optimum choice- prioritizes various alternatives and select the best alternative
- Feedback and control- review performance of the overall process

2.7.3.8 Earn value analysis technique (EVA)

Earned Value Analysis is a technique for measuring progress at any given point in time in a project, forecasting its completion date and final cost, and analyzing variances in the schedule and budget as the project proceeds (Cullen, 2010). It is a quantitative project management technique for controlling costs by evaluating project performance and predicting final project results, based on comparing the work progress, budget, and actual costs. It, therefore, provides the managerial team with insight into potential problematic areas that could facilitate mitigation plans and control such problems before happening (Czarnigowska, 2008). The trend in studies (Czernigowska, 2008; Czarnigowska, et al., 2011; Gupta, 2014) have validated the effectiveness of the EVA technique for effective project cost monitoring and control during the construction stage. Some of the advantages of the EVA as identified by Humphreys and Associates (2012) include:

- Provides early warning of potential problems
- Identify problem areas for proactive management attention
- Improves project visibility and accountability
- Enables accurate cost reporting

The EVA uses the Planned, earned and actual Value to evaluate project performance (Table 2.8).

Table 2. 8: Key Components of Earn value analysis

Variable	Measures	Description
Planned Value (PV)	Schedule	How much work is expected to be done?
Earned Value (EV)	Schedule and Budget	How much work is actually completed?
Actual Cost (AC)	Budget	What is the actual cost of work completed ?

Source: Compiled from PMI (2008)

As detailed in studies by Bhosekar and Vyas (2012) and PMI, (2008), the following processes are used to determine variance and forecast performance for control purposes on the project:

To determine variance:

Cost variance Cv is calculated by deducting the actual cost is from the earned value

- Cv = EV – AC………………………Eqn 2.

Schedule variance Sv, is calculated by deducting the planned value from earned value

- Sv = EV – PV………………………Eqn 3.

A positive Cv and Sv indicates good performance

To forecast performance

Cost performance Index CPI is calculated by dividing earn value by actual cost

- CPI= $\frac{EV}{AC}$ ……………………………….Eqn 4

Schedule performance Index SPI is calculated by dividing earn value by planned value

- SPI= $\frac{EV}{PV}$ ……………………………….Eqn 5

CPI and SPI >1 indicates good performance. Forecast on final cost to accomplish a project (EAC) can also be determined by summing the costs of work completed (AC) with the cost of work yet to be undertaken (ETC). This is illustrated in equation 6.

- EAC= $AC + ETC$ ……………………………..Eqn 6

2.7.3.9 Activity based costing technique (ABC)

A modern cost estimating technique for allocating indirect costs to products based on cost drivers of various levels and models usage of organization resources by the activities performed and the cost of these activities to outputs (Ayachit, et l., 2014; Zu'bi & Khamees, 2014). The basis of activity-based costing is that projects consume activities and activities consume resources. As such, costs are initially assigned to activities (the discrete tasks that need to be completed to deliver the project) and then assigned to projects, based on each project's use of resources. Activity-Based Costing (ABC) is a technique that involves a two-stage approach for allocating indirect costs to products to activities and their cost drivers. Notwithstanding the benefits of its application, ABC presents some drawbacks when compared to a traditional cost estimating technique.

2.7.3.10 Target value design technique (TVD)

According to Zimina et al. (2012), TVD is an improved TC adjustment to construction. It is a management practice aimed at generating maximum value according to an actual fixed cost at a price below market value and as a method of continuous improvement and waste reduction (Ballard, 2012). This modern project cost management technique is a new value engineering based technique implemented in many lean practices and integration project delivery (Pardis-Borzorgi et al., 2013). TVD is a feed-forward cost management technique that facilitates waste reduction from the predesign stage through to the design stage. Its aim is to satisfy and possibly exceed the client's expectations by making a client's value (specific design criteria, cost, schedule) a driver of design (Macomber et al., 2007; Ballard, 2012;

Zimina, et al., 2012; Do et al., 2014). It employs procedures similar to cost planning and value engineering but mainly depends on team's collaboration in the concurrent planning, design and estimating process. This technique is primarily employed to set and plan project cost at the predesign and design stages. It finds innovative ways to cost savings without compromising quality. Ballard and Reiser (2004), Robert and Granja (2006), and Do et al., (2012) amongst others have reported its successful implementations on various construction projects in improving cost performances. Hence, an effective technique for cost management. An investigation report by Nayak (2006) and Zimina et al. (2012) on Lean projects has confirmed that the TVD is effective for cost reduction and continuous improvement. It is no wonder that TVD is gaining awareness and acceptance in developed countries where it has been employed to set and plan project costs at the predesign and design stages to facilitate improved project cost performances.

2.7.4 Project Cost Management Process

The process parameter of the CMS is where the techniques are used to adequately manage the various project cost elements towards effective performance outcomes. The PMI (2008) described the cost management process as consisting of four stages: project planning, cost estimating, budgeting, and controlling project cost. Haughey (2014), identified five stages: planning, estimating, budgeting, monitoring, control and reporting of the project cost. However, studies by Ballard (2012) and Zimina et al. (2012) added the setting stage to the process. This stage precedes the planning and estimating stage and employed at the predesign stage of project delivery. Therefore, the process stages can be summarised under four main headings namely: setting, planning and estimating, budgeting, monitoring, and control. These stages are implemented via two main approaches design-cost-control and cost-design-control. Furthermore, there are certain key performance pointers associated with each process stage. The performance pointers measure how effective the process stages are executed creating a platform to predict system outcomes. The following subsections discuss the process stages, approach and performance pointers.

2.7.4.1 Process Stages

- *Setting Stage*

The setting stage conventionally involves determining the budget. The budget is the amount what the client is will spend on the project after design development. However, in modern contemporary practice, following arguments towards cost and value performance improvement (Zimina, et al., 2012; Ballard, 2012) it includes determining the client budget as well as the target project cost before the design development. Hence, it takes place during predesign and techniques such as TC and TVD are identified most suitable for this stage.

- *Planning and estimating stage*

This stage involves series of skills and adjustments to regulate and determine elemental cost with a predetermined sum, in readiness for tender documentation. Traditionally, it follows cost estimation for a budget recommendation before designs and monitoring the budget while the design undergoes development (Towey, 2013). Therefore, involves an iterative procedure involving: reviewing and updating the original budget estimate in line with up-to-date information. The designs and cost targets are determined at this stage, and it requires the use of techniques that can facilitate design alternatives and cost plans such as CP, TVD, TC, VE, CE, and ABC.

- *Budgeting stage*

This stage is concerned with aggregating the estimated costs of individual activities or work packages into an authorized cost baseline (PMI, 2008). The procedure involves estimation of costs, subsequent analyses, frequent revisions, and, to some degree, intuition through regular interaction among concerned parties. Essentially, project cost budgeting incorporates the allocation of resources to various work packages, along with a schedule to ensure that the project can be delivered within the expected cost (Venkataraman, & Pinto, 2008). In many cases the cost baseline is produced at the design stage, however, in some other cases, the contractor also carries out this process at the construction stage (Sanni &. Duruola, 2010). Techniques such as CE, ABC and cost schedule (cost scheduling also referred to as the cost breakdown structure expressed over the duration of the project) are useful because of the estimation required. Though ABC is identified more appropriate for estimating overheads

(Zu'bi & Khamees, 2014). The expected output from the project cost budgeting stage is the cost baseline that provides a clear picture of cost against project milestones.

- *Monitoring and Control stage*

This stage of the process is concerned with monitoring the status of the project to update the project budget, control changes that can negatively affect the cost baselines, and finally, reporting actual cost spent. This stage is carried out during construction. Techniques such as CE, ABC, EVA, OSRC, and CFA associated with project cost control can be used. While the ABC is identified to be effective to control overheads during construction, the OSRC is useful in managing material, Labour, and plant on site. CFA, on the other hand, is capable of reporting cash disbursement on the project and EVA analyses real-time cost performance monitoring set cost baselines and actual performance.

2.7.4.2 Process performance pointers

A performance pointer is a measure of a process that is critical to the success of activity (Swan & Kyng, 2004). It measures the effort and outcomes that need to be observed and achieved during the implementation process to ascertain progress towards project objectives. The purpose of identifying the main performance pointers are to enable the measurement of the success of a particular process or activity (The KPI Working Group, 2000 in Chan & Chan 2004). Therefore a key performance pointer is used to examine the success of a particular activity undertaken in the project.

There are a number of performance pointers for measuring project success documented in literature. However those common pointers perceived to be associated with cost management activities in construction projects include: cost predictability, progress deviation, cost deviation, decision effectiveness and cost-effectiveness (Pillai et al. 2002: Takim & Akintoye 2002; Chan & Chan, 2004; Toor & Ogulana 2010). Further findings from a review of the studies by Pardis-Borzorgi et al. (2013), Zimina et al. (2012) and the PMI (2008) also highlights four key performance pointers associated with the cost management process. These pointers are:

- Setting stage: Effective target cost for the project
- Planning and estimating stage: Effective cost targets for each element in the project

- Budgeting stage: Operational cost baseline on which cost performance during construction can be evaluated.
- Monitoring and control stage: Effective cost performance index and to- completion forecast.

These four indicators apparently covers cost predictability, cost deviation and cost and decision effectiveness.

2.7.4.3 Process approach

The four highlighted process stages can be executed using two main approaches referred to as the design-cost-control approach and cost-design-control in this context.

- *Design- cost-control approach*

The Design-cost-control approach process involves the determination of the project cost based on final estimates from design. According to Ashworth (2010) at the predesign stage, the client budget is a guide for design development. At the completion of the design, the cost is calculated to arrive at the project target cost (the final estimate). The project cost is benched marked on this estimate, and then the budgeting processes are carried out followed by project cost control at the construction stage. This approach can be considered a reactive management approach (Ballard, 2002). In this approach, the client sets the budget and target cost while the cost management process solely dependent on the judgment and intuition of the Architect. Langston (2002) argues that this approach has a tendency to be inadequate and ineffective because the initial decision to arrive at the project cost is dependent on the architect and not the entire PMT. He argued that until this process is done collaboratively, improvement in cost management and performances will continue to be a mirage.

- *Cost-design-control approach*

This approach emerges from the principle of making target costs and cost data direct inputs to the design process instead of the outcome of it (Ballard, 2012; Zimina et al., 2012) an approach that associates with modern CMS. The approach requires the target project cost be set before any form of design is carried out. In this approach, the project cost is determined at the setting process situated in the predesign stage through the collaboration of the client and project team. Next is the allocation of elemental costs target through the planning and estimating process to which is implemented at the design stage determine from which cost budgeting is determined. Next stage is the project monitoring and control which involves both onsite resources control, cost projection and variance assessment to ensure that the target project cost is not exceeded.

Dell'Isola (2002) and Jaggar et al. (2002) argues that in achieving effective project cost management effective decisions on cost should begin at the early start on CMS process at the predesign stage. Otherwise, the cost to implement change during construction becomes high-priced. This logic is illustrated in Figure 2.13 where cost optimization through effective cost management achieved from the predesign stage. The cost of changes as shown are higher as the stage progresses to construction. This approach can be considered as a proactive management approach to cost management.

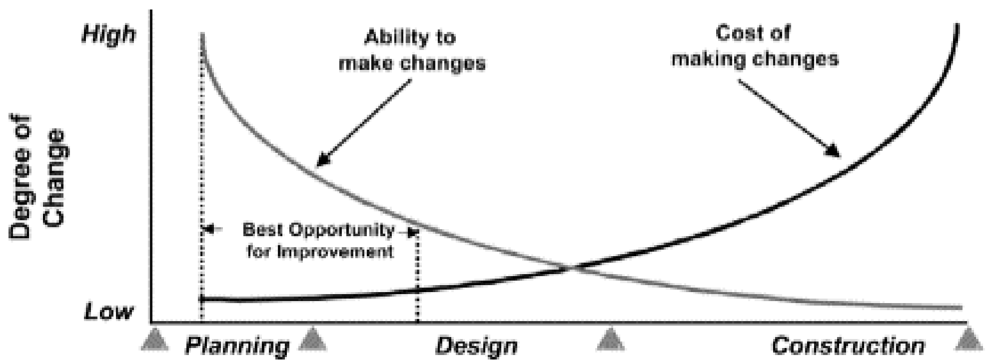


Figure 2. 13: Project delivery stages and effective cost management relationship

Source: Adapted from Dell ‘Isola (2002)

2.7.5 Project Cost Management Systems and Cost performances

As the construction industry struggles to increase the number of successful outcomes and certainty on projects cost (Pishdad-Bozorgi et al., 2013), several scholars have espoused the relationship between effective CMS and cost performance. Scholars such as Obi et al. (2015), Do et al., (2014), Smith (2014), and Kern and Formoso (2006) to mention a few espoused that employing an effective CMS can lead to effective cost performances and vice versa. According to Do et al. (2014), the efficacy of the cost management system is fundamental to the level of effective cost performance that will be experienced. Therefore, an effective CMS is concerned with how the cost will be effectively managed by providing a useful guide to making decisions relevant for effective planning, controlling and developing competitive strategies. Furthermore, the Association for Project Management (APM) UK, (2014), has stated that an effective CMS should be able to provide a managerial overview of cost implications of decisions throughout the project delivery process, particularly at the early stages and be able to draw the project management's attention to problem areas. Therefore, an effective CMS is key to achieving effective project cost management.

Apparently, CMS can be categorised under the headings of conventional and modern based on their characteristics of the techniques, process approach, and management style. A conventional cost management system is characterized by conventional techniques and a design-cost-control process approach. Some of the commonly cited conventional techniques identified include; CP, CFA, CR, and OSRC (Obi & Arif, 2015; Chigara et al., 2013; Olawale & Sun, 2010). Scholars espouse that this system is predominant in use on many construction related projects across the globe. However, critiques highlighted some its limitations some of which include the inability of the system to provide accurate project cost, support stimulation of strategic decisions, and improvement of project cost performance (Kern and Formoso, 2006; Hanid et al., 2011). The reliance on the outcome of designs to set project target cost and monitoring detection of negative variances without proactive strategies for their mitigation (Ballard et al., 2002). Furthermore, its failure to forecast and identify improvement opportunities and relative neglect of value consideration are limitations of the system. These limitations make the system focus on reactive management, rather than pro-active management towards effective project cost performances. Hanid et al. (2011) following concerns on the limitations of conventional CMS in project delivery, recommends the use of modern CMS for improved cost management and performances.

Modern CMS evolved to overcoming some of the limitations of conventional CMS. It adopts more proactive strategies that focus on providing a managerial support that facilitates effective decision-making, planning, and proactive cost control towards cost reduction and value improvement. Scholars (Kern & Formoso, 2004; 2006; Hanid et al., 2011; Zimina, et al., 2012) describe modern CMS as client oriented and focuses on management decision support to aid effective planning and project cost control towards cost savings, value improvement, and effective cost performances. Modern CMS employs modern techniques or a hybrid of conventional and modern techniques in a cost-design-control process approach (Zimina, et al., 2012; Do et al., 2014; Czernigowska, 2008; Waris et al., 2012; Gupta, 2014). The integration of the best of conventional and modern cost management techniques in the cost management process (Kern & Formoso, 2004) improves the performance of the system. Some commonly identified modern techniques used are TC, TVD, VE, ABC and EVA. However, it is expected that with future demands in client objectives and the construction environment, new modern techniques will emerge and modern CMS will keep evolving. Based on the characteristics of modern CMS it implies that the system possesses a greater advantage in achieving effective project cost management and performances in project delivery than the conventional CMS.

However, in spite of the emergence of modern CMS, contemporary findings show that conventional CMS are still very much in use in projects delivery in developing countries (Azis et al., 2012; Sanni & Durodola, 2012; Chigara et al., 2013; Obi &Arif, 2015). A study by Chigara et al. (2013) found that CR, CE, cost scheduling, variance analysis, cost value reconciliation and OSRC are considered effective in the CMS implementation in projects in Zimbabwe. They stated that this finding was not significantly different from those employed in other developing countries, such as South Africa, Botswana, Nigeria, and Uganda. They concluded that many of the techniques used in the construction stage suffer from lack of real-time reporting which is one of the identified limitations of conventional CMS. Furthermore, their findings acknowledged that some contractors admit experiencing poor cost performances despite the utilization of some of the techniques.

Similarly, in the Nigerian construction and housing sector, Iroegbu et al. (2010) identified CE and CP as effective techniques in the CMS. They, however, espoused that CP is rarely used on many building projects maintaining that its lack of use is one of the contributing factors to poor project setting and planning in project delivery. Sanni and Durodola (2012) also identified, working budget (cost scheduling) and OSRC, as key techniques for effective cost control frequently employed on building projects in Nigeria. Obi and Arif (2015) further identified CE, CFA and cost scheduling techniques as commonly used techniques in LcH project delivery. From their study, they found out that these techniques though effective, were inappropriately used for setting and planning project cost affecting eventual system outcomes. Both Iroegbu et al. (2010) and Obi and Arif (2015) emphasised that, though the CE is effective, the sole dependence on this technique to set and a plan cost is insufficient to deliver the expected performance pointers of the cost management process. They recommended techniques such as Target cost planning and the TVD to improve the efficacy of the CMS, particularly at these stages. Hence, it is observed that conventional techniques are popularly used indicating that the CMS in use in project delivery could be predominantly conventional. Though many of the conventional techniques are identified effective, they should be employed at appropriate process stage.

Discovery from the above review, identifies an effective CMS as one that provides a useful guide to assist decisions relevant for effective planning, controlling and developing competitive strategies. In addition one of the main characteristics of an effective CMS is its ability to actualise specific performance pointers of the cost management process that will lead to a successful system outcome. Therefore, the CMS should include most suitable techniques and process approach necessary to achieve process performance pointers towards a beneficial CMS outcome.

However, creating an environment for viable implementation within the CMS also requires the consideration of certain factors. According to studies (Windapo, 2013; Sanvido, 1988), these factors act as regulators in the choice of techniques and moderates the process implementation. Whereas the performance pointers evaluate the level of success of each process stage in the CMS, these factors other than techniques are necessary for achieving the pointers and ensuring effective CMS implementation. Hence, understanding their effects and relationship with the techniques and process is important for successful CMS implementation. The next section reviews extant literature on implementation success factors for better understanding and further contextual investigations.

2.8 IMPLEMENTATION SUCCESS FACTORS (IMSF)

This section discusses the various factors necessary for viable implementation of techniques and processes in the CMS. It starts by defining the term and proceed to systematically review existing studies on IMSF.

2.8.1 Contextual Definition of Implementation Success Factors

The term success factors, in the context of project management, was first used by Rockart (1982) and has been defined in various ways by different authors (Hwang & Lim, 2012). In addition to varying definitions, some studies also have different taxonomies such as mitigating factors (Olawale & Sun, 2010). However, in this study the term implementation success factors (IMSF) is used. Table 2.9 present some of the common definitions of IMSF. Some of the definitions identifies IMSF as drivers of successful management systems implementation while others refer to it a determinants for successful performances.

Table 2. 9: Definition of implementation success factors

Publication	Definition of IMSF
Belassi and Turkel (1996)	Factors outside the control of management that can influence the project
Rowlinson (1999)	Fundamental issues inherent in the project which must be maintained for the project team to work effectively and efficiently
Chua (1999)	Factors that determine the success of the achievement of the project major objective of time, cost and quality
Chen et al. (2011)	Input factors to the management system that leads directly to the success of a project
Kog and Loh (2012)	Factors that determine the success of the achievement of the project major objective of time, cost and quality
Arcilia (2012)	Those factors that determine the success of the achievement of project objectives: Budget, quality and schedule
Morad and El-Sayegh (2016)	Factors for successful implementation of techniques within a cost management system

Source: compiled by author from publications

Therefore, considering the definitions as put forward by Chen (2011), and Morad and El-Sayegh (2016) IMSF in this context is defined as the essential factors embedded in the control parameter required to maintain viable implementation within the CMS. These factors facilitate systematic and quantitative assessment with the view of selecting appropriate methods and approach that can achieve the performance pointers of the process stages.

To further buttress the relevance of IMSF, Takim and Akintoye (2002) illustrated the relationship between IMSF, project management performance, and project success as shown in Figure 2.14. The depicted relationship reveals that success is a direct product of management performances and management performances a product of success factors. Therefore, project success is an indirect product of IMFS. This relationship depicts that the IMSF are instrumental to effective operation in any system that aims to achieve success.

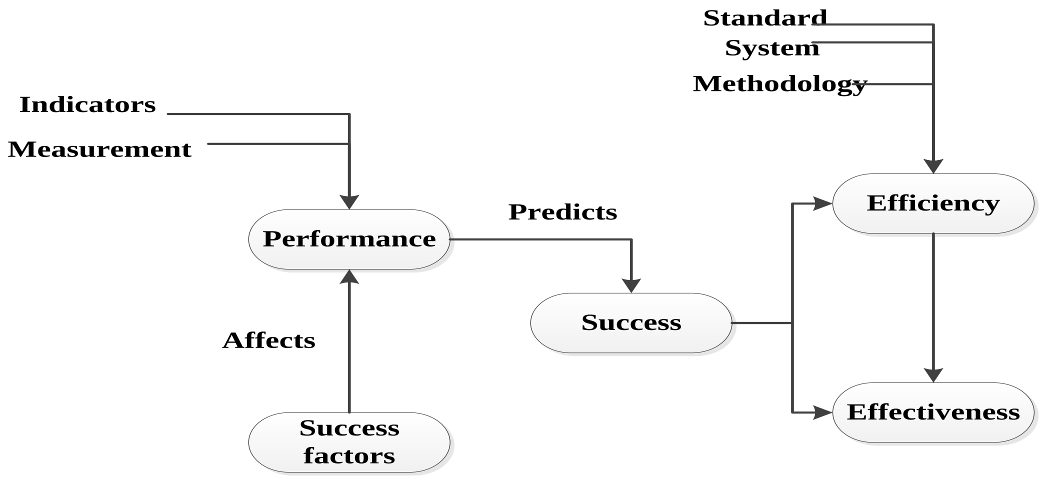


Figure 2. 14: Relationship between IMSF, Project Performance and Project Success

Source: Takim and Akintoye (2002).

Therefore, an understanding of the IMSF will increases the possible chances of effective CMS implementation.

2.8.2 Implementation Success Factors and Associated Drivers

IMSF are associated with the project internal and external elements. Studies by Chan et al. (2004), Mbachu and Nkado (2007), Olawale and Sun (2010), Ihua et al (2014), and Akanni et al. (2015) to mention a few espoused that project internal element include, project related factors, PMT related factors, management related factors and project characteristics related factors. They also identified project external element as external factors related. In their views, the factors associated with project internal element occur more persistently and requires constant control by the PMT. On the other hand, factors associated with the external project element is uncontrollable by the PMT and have lower frequency of occurrence on management systems. However, findings from a study by Olawale and Sun (2010), Morad and El-Sayegh (2016) indicates that the PMT need the IMSF for consideration in CMS implementation.

Extant literature documents a variety of drivers associated with IMSF. Pinto et al. (1987), Saqib, et al. (2008), Tan et al. (2011), and Adnan, et al. (2014), identified key drivers for construction project performances. Chua, et al. (1999), Iyer and Jha (2005), Arcilia (2012), Hwang et al. (2012), and Kog et al. (2012), identifies the key drivers for effective cost performances. While Tang (2005) and Olawale and Sun (2010) identified key drivers for project cost management. Similarly, in the Nigerian context, Ogwueleka, (2011), Amade et al. (2015), and Okoye et al. (2015) identifies the key drivers for effective cost management and performances in public sector construction projects (LcH inclusive). The key drivers identified across these studies are documented in Table 2.10.

Apparently, a critical assessment of these studies shows a consensus on 13 specific salient drivers for project cost performance and management. The identified drivers mainly human, management and external related. This finding suggests that these drivers could be can be significant in achieving effective project cost management and performances. However, the identified drivers are from generic contexts and not peculiar to CMS implementation in LcH project delivery creating the need for further contextual investigations. Nevertheless, before further investigations in the context of CMS implementation in LcH project delivery, it is needful to have an understanding of the identified 13 drivers.

Table 2. 10: Key divers for successful project management and performances

	Driver	Amade et al. (2015)	Okoye et al. (2015)	Adnan, et al. (2014)	Ihua et al., (2014)	Arcilia (2012)	Hwang and Lim (2012)	Kog and Log (2012)	Ogwueleka (2011)	Tan et al.(2011)	Olawale and Sun (2010)	Saqib et al. (2008)	Iyer and Jha (2005)	Tang (2005)	Chua, et al. (1999)	Pinto and Slevin . (1987)
1	Effective project planning and control	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
2	Project management team competency	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
3	Budget update,					√	√	√	√	√					√	√
4	Constructability,			√		√	√	√			√		√	√	√	√
5	Economic stability	√		√	√	√	√	√	√			√	√		√	
6	Project management team collaboration	√	√	√	√	√	√	√	√	√	√	√	√	√	√	
7	Clear project brief			√	√	√	√	√	√			√	√		√	√
8	Risk identification and management,				√	√	√	√	√	√	√			√	√	
9	Early contractor involvement		√	√		√			√	√		√	√			
10	Adequate cash flow	√		√	√	√	√	√	√	√		√	√	√		
11	Adequate designs and specifications	√	√		√	√	√	√	√	√	√	√		√	√	√
12	Adequate project team selection and early engagement	√	√													
13	strong monitoring and evaluation system	√	√	√												
14	Effective procurement process,	√	√	√		√										
15	Weather Conditions	√		√	√		√	√	√	√					√	
16	Availability of information and cost data					√					√			√		

Source: Compiled by Researcher from publications

2.8.2.1 Availability of cost data

Akintoye (1998 cited in Tang, 2005) and Tang (2005) pointed out that cost data is critical in achieving effective project cost management because it guides the estimator's judgment in improving the accuracy of current estimates. Cost data are information on building costs collected from published price books, cost information publication services, trade journals and feedback from actual projects based on tacit knowledge of the PMT. Hence, availability of cost information is necessary for cost effective planning and estimating.

2.8.2.2 Adequate designs and specification

The adequacy of designs and specifications is critical for control project cost. It facilitates effective planning and cost control and provide essential feedback during planning, budgeting, and control process. According to Shrestha and Mani (2013) successful public projects, completion within reasonable costs is essential because government fund these projects such as LcH from taxes. Therefore, the adequacy of project designs and specifications can facilitate effective project cost planning and control.

2.8.2.3 Competent project team professionals

Competence refers to the degree of skill, knowledge, and experience the team members possess which guides their input in the CMS implementation (APM, 2015). The PMT needs to be wholly competent, qualified and experienced in their professional roles as well as specific roles affecting the CMS because their efficiency influences the input and outcome of the CMS (APM, 2015; Alexandrova et al., 2012). Therefore, a competent PMT can facilitate effective management and performance outcomes on a project.

2.8.2.4 Effective project planning and site supervision

Effective project planning and site supervision facilitate effective coordination and integration of project activities (Tan et al., 2011). This driver enables the team to precisely program and documented deliverables, schedule, monitor real time and produce cost scale as well as active project site resources control (Haughey 2014). An understanding is needful to meet the purpose and values of the project pursuing necessary procedures that lead to effective planning and control on projects. Hence, the team commitment to effective project planning and supervision (control) is essential.

2.8.2.5 Early contractor involvement

This enhances strategic decisions that can affect the project planning, designing and control in a cost-effective manner. The contractor's tacit knowledge from similar projects is a useful input that can influence the CMS positively (International Association of Dredging Companies (IADC), 2011). This involvement will facilitate effective contributions needed for strategic decisions early in the project life. Furthermore, it fosters better cooperation between the contractor and other project management teams throughout the project delivery (Song et al., 2009). Hence, it is a driver that can assist in the strategic decision process needed to plan effectively, estimate and budget project cost at an early stage to deliver best value to the client.

2.8.2.6 Effective team collaboration and commitment

Collaboration entails teamwork to accomplish a task and solving difficult problems (Schrage 1990). It embraces, coordination and trust for interactive teamwork and a two-way communication to manage and share knowledge effectively to solving both individual and project focused tasks (APM, 2015; Mishra et al., 2009). Therefore, information, communication, trust are identified as essential ingredients of effective collaboration and commitment.

2.8.2.7 Clear and well-detailed client project brief

A clear client project brief defines the strategic project outcomes of the project in terms of purpose, the set objectives, the requirements and the target market (APM 2015). This statement implies that identifying client requirements in terms of cost and value and provides a good idea of expected project outcomes. Hence, it is necessary to guide the project management team from predesign through construction on effective management of costs on the project.

2.8.2.8 Constructability

Constructability emphasizes the ability to build, the importance of construction input and recognizes the principles of construction to achieve project objectives (Arcilia, 2012; Kog & Loh 2012). It underpins the optimum use of construction knowledge and experience in planning, engineering, and field operations to ensure that procedures adopted by the PMT on the project can lead to eventual success. This is necessary because the principles or method of construction proposed will influence the way in which project cost management will be adequately managed.

2.8.2.9 Effective risk management

Early identification of risk at the outset of a project is considered essential for project cost and time control to be effective (Olawale and Sun 2010). Risks can affect cost control, and the level of their influence can be difficult to assess (Akintoye et al., 1998). Therefore, for effective CMS implementation considerations to allocate a contingency cost for risk management may be necessary.

2.8.2.10 Budget update

The budget update involves appraising approved changes in the target cost that affect the cost baseline (Arcilia, 2012). In achieving effective project cost control, the PMT must be aware of any changes in that can significantly affect the cost baseline and ensure that such changes are coverable by the contingency cost set-aside use to cover small budget modifications. Changes affect cost control and in the case of LcH projects where tight budgets are predominant (Shrestha & Mani, 2013) change orders must be properly reviewed before implementation. Therefore, for effective cost control project budget updates are needed to mitigate unnecessary project expenses.

2.8.2.11 Adequate and effective cash flow

Cash flow is the actual movement of money in and out of a project, and effective cash flow is vital to successful project delivery (Usman et al., 2016). The effective and timely flow of money into the LcH project is one of the key client's obligations (Saisi, et al., 2015) that can enhance the consultants, contractors and suppliers’ effectiveness in discharging their duties during the cost management process. This indicates the importance of adequate working capital to enable the contractor maintain workflow on the project which is necessary for effective cost control process.

2.8.2.12 Stable economic stability

Declining revenues, rising debts, and fiscal shortfalls are all triggers of economic instability. This driver from the level of general economic activity impacts on the construction environment as well as the resources available to carry out the construction activity (Akanni et al., 2015). Therefore, a stable environment allows for market stability and adequate money circulation within the economy. This flow will apparently affects the construction market influences management decision on the project resources. However, there are periodic economic cycles, which can necessitate forecasting of economic trends both local and global context. Therefore, economic instability can influence management performances on a project.

2.8.2.13 Stable Weather Conditions

Evidence show that weather conditions are not easily and accurately predictable. The effect of torrential rains as found in tropical regions is such that causes material resources waste on LcH project site where proper preventive measures are not in place (Ihua et al., 2014). The adverse effect of poor weather conditions consequently affects construction cost control. Since it does not appear realistic to control the weather, factoring possible alternatives in project planning is necessary to cushion the adverse effects of project cost management.

2.9 COST MANAGEMENT SYSTEM MODELS FOR LOW-COST HOUSING PROJECT DELIVERY

A model represents the reality of an actual object, process, or system (Fellows & Liu, 2015). Apparently, several management system models are found in literature, but only a few are CMS particular. Some of the CMS models for LcH project delivery include LcH project cost management framework developed by Oladapo (2001), the Integrated Project Cost Management model developed by Kern and Formoso (2004: 2006), and the Target costing framework developed by Jacomit and Granja, (2011). A review of these identified models will facilitate a clear understanding of their strength and weakness that will assist in the development of an appropriate system model for cost management in LcH project delivery in the Nigeria.

2.9.1 Low-cost Housing Project Cost Management Framework

Several CMS models are found in literature, however, those specific to LcH project delivery are rare. Oladapo developed this framework, presented in Table 2.11 in 2001. It highlights a guide for cost management at each phase of the LcH project delivery process. He proffered the framework to assist project sponsors and managers in effective cost management on LcH projects in Nigeria. According to him, the establishment of project characteristics, project organization, procurement systems, management systems and procedures and the effect of environmental factors is essential to fulfil project objectives. Therefore, CMS need to be effective and efficient. This framework, documents some techniques, process stages and approach and IMSF drivers. It listed life cycle costing and vale engineering as techniques, the cost-design approach and the monitoring and control process, and constructability, project planning and cash flow IMSF drivers. However, it does not show a clear link on the structure and relationship of these elements in the framework.

Table 2. 11: Low- cost housing cost management Framework

Strategy	Design and tender documentation	Tender process	Construction	. Project evaluation
-Identification of housing needs - Identification of environmental issues, technology, cultural, regulations technical capabilities etc. -Sustainability and environmental assessment -Procurement systems, project organisation: -Appointment of principal professionals -Establish cost model: -Land acquisition + building permission - -Prepare feasibility study, cost benefit analysis and funds/cash flow -Prepare -project master plan -Overall management strategy	-Design and tender documentation - Prepare implementing manual and management guidelines - Design to cost plan (schematic and detailed drawings) - Cost checks and reviews: Priced Bills of Quantities - Life cycle costing and maintenance issues - Value management - Basic or simplified conditions of contract - Tender documents: Bills of Quantities, specifications etc. - Design flexibility: provide for expansion and upgrading and constructability. - Stakeholders participation in design - Pre-qualifications	- Issue of documents - Tender briefing - Tender analysis, interviews and selection - Contract award - Cost checks and reviews	- Contract organisation, management, and administration. - Monitoring and cost control - Constructability reviews - Bills of Quantities as materials purchasing document - Payment procedures through community bank - Commissioning	-Analysis and review of cost plan - Data bank and updating etc.

Source: Compiled research from Oladapo (2001)

2.9.2 Integrated Project Cost Management System Model

Kern and Formoso developed this model in 2006 for generic cost management in building project delivery in Brazil. The model focuses on technical improvement of the CMS employed in Brazilian building projects. They developed the model through case studies of building projects encompassing LcH projects. The researchers relied on the platform of the conventional cost management process model, shown in Figure 2.15 to develop the model is as shown in Figure 2.16.

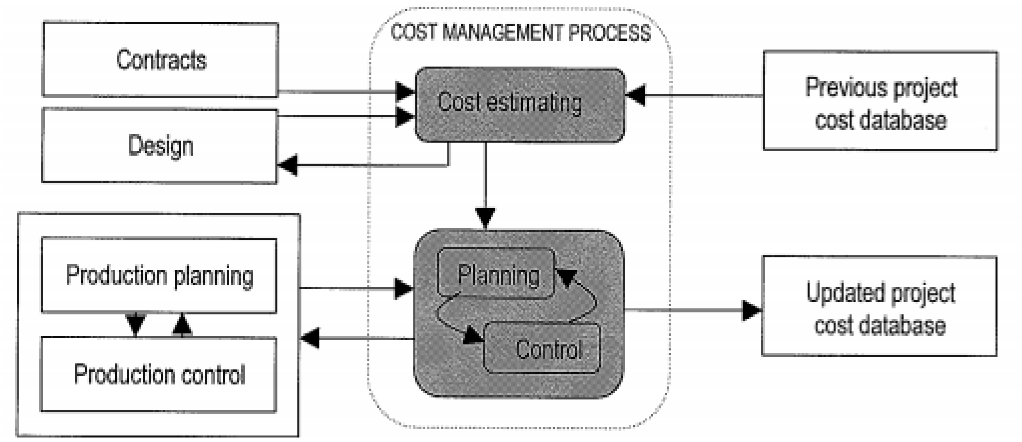


Figure 2. 15: *Cost management process model*

Source: Kern and Formoso (2006).

Figure 2.16 show that Target costing, operational estimating and S-curve were techniques integrated into existing conventional cost management process model. TC supports early project decisions on design, supply chain, and production system design. Such decisions must take into consideration the target cost established for the project at the planning and estimating stage. The integration of TC characterised the modelled system as a modern CMS. The operational estimating technique uses the information from the design and planning programme to develop activity costs and assessing the impact on target project costs and duration. The S-curve technique employed in the cost planning and control sub-process, assist in monitoring, forecast, and control of cost resources at various milestones on the project.

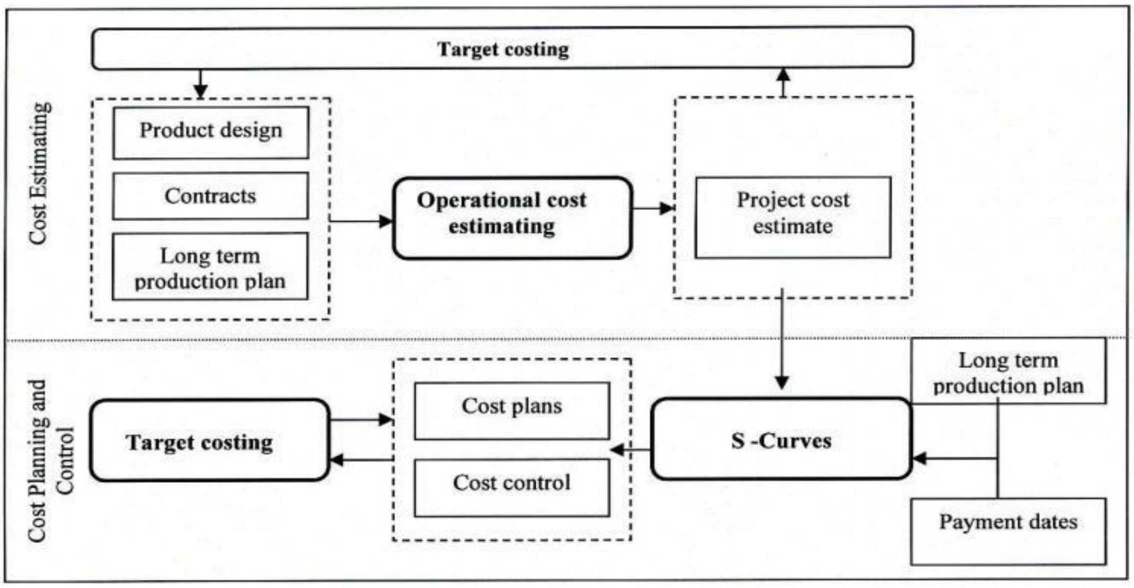


Figure 2. 16: Integrated cost management model

Source: Kern and Formoso (2004).

2.9.3 Target costing Framework

In an attempt to improve the project cost management system used in LcH projects in Brazil, Jacomit and Granja (2011) developed the target-costing framework, Figure 2.17. This framework describes how integrating TC in the CMS can improve Brazilian public social housing projects cost performance. The research framework development emanated from the findings of two case studies on Brazilian social housing (Jacomit &Granja et al., 2011). In their view, TC is an improvement in technical consideration of the CMS. The standardization and replication of the design in LcH projects are identified opportunities for TC adoption while the bidding process and the outsourcing design will reduce the applicability of TC on the project. They highlighted that by adopting TC in the CMS:

- Cost constraints and user´s value perception should serve as a trigger to induce creativity in the design process, as a way of seeking innovative solutions that bring more quality for the product delivered while taking into account the interests of all stakeholders;

- All project stakeholders should participate actively and collaboratively from the early stages of the design process;
- It is important to establish one cardinal rule: target project cost cannot be exceeded. However, in the pursuit of this objective, the quality of the final product also cannot be sacrificed. Therefore, it is necessary for greater collaborative efforts, so that the attributes that do not represent value for the customer can be replaced or that creative solutions are achieved without sacrifices for any actors involved in the process;
- Workshops with all stakeholders should be carried out to establish, clearly, the principles of the TC and the perceptions of value and quality.

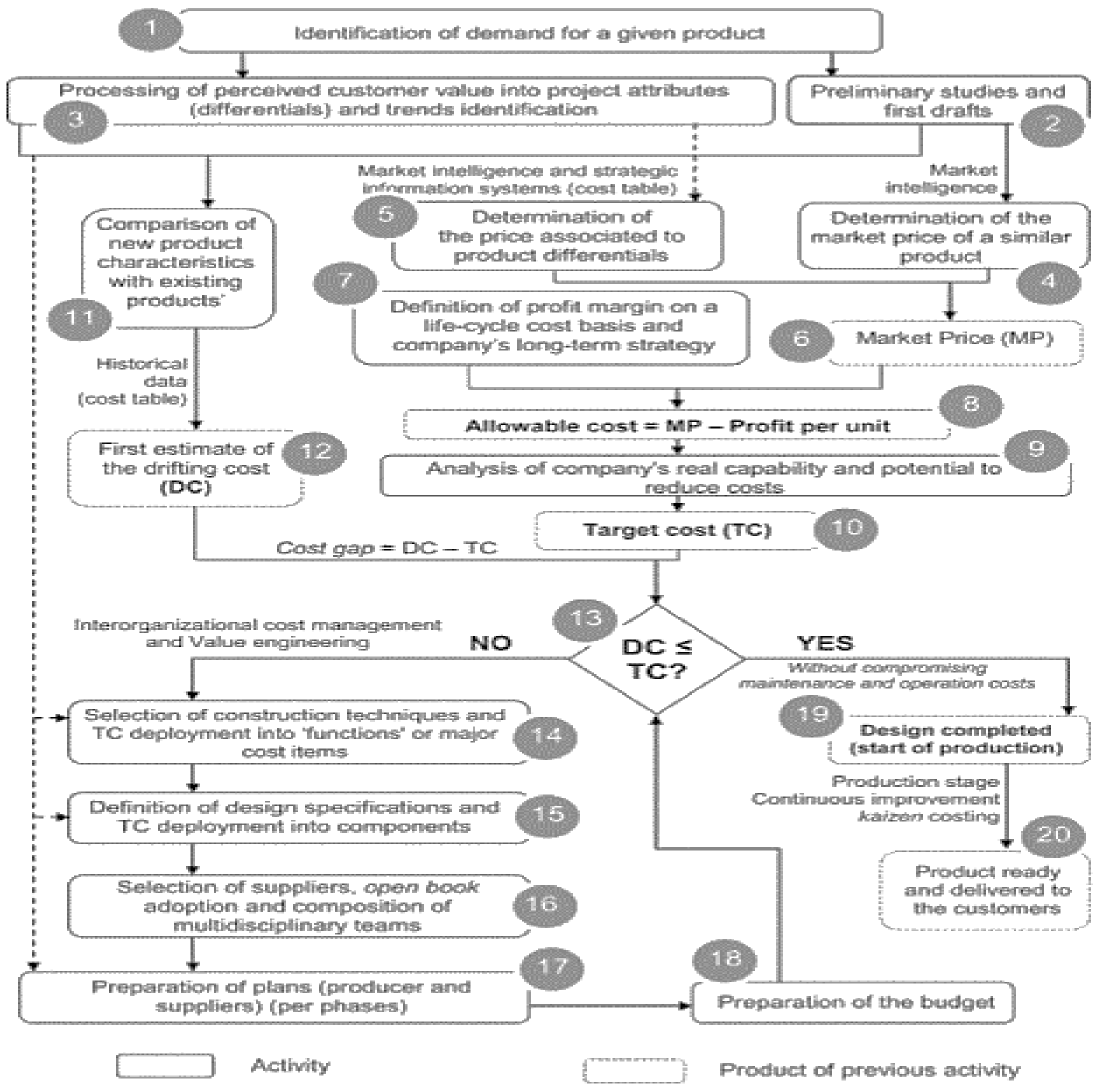


Figure 2. 17: Target costing Framework

Source: Jacomit and Granja (2011)

2.9.4 Strength and Weaknesses of the Selected Models

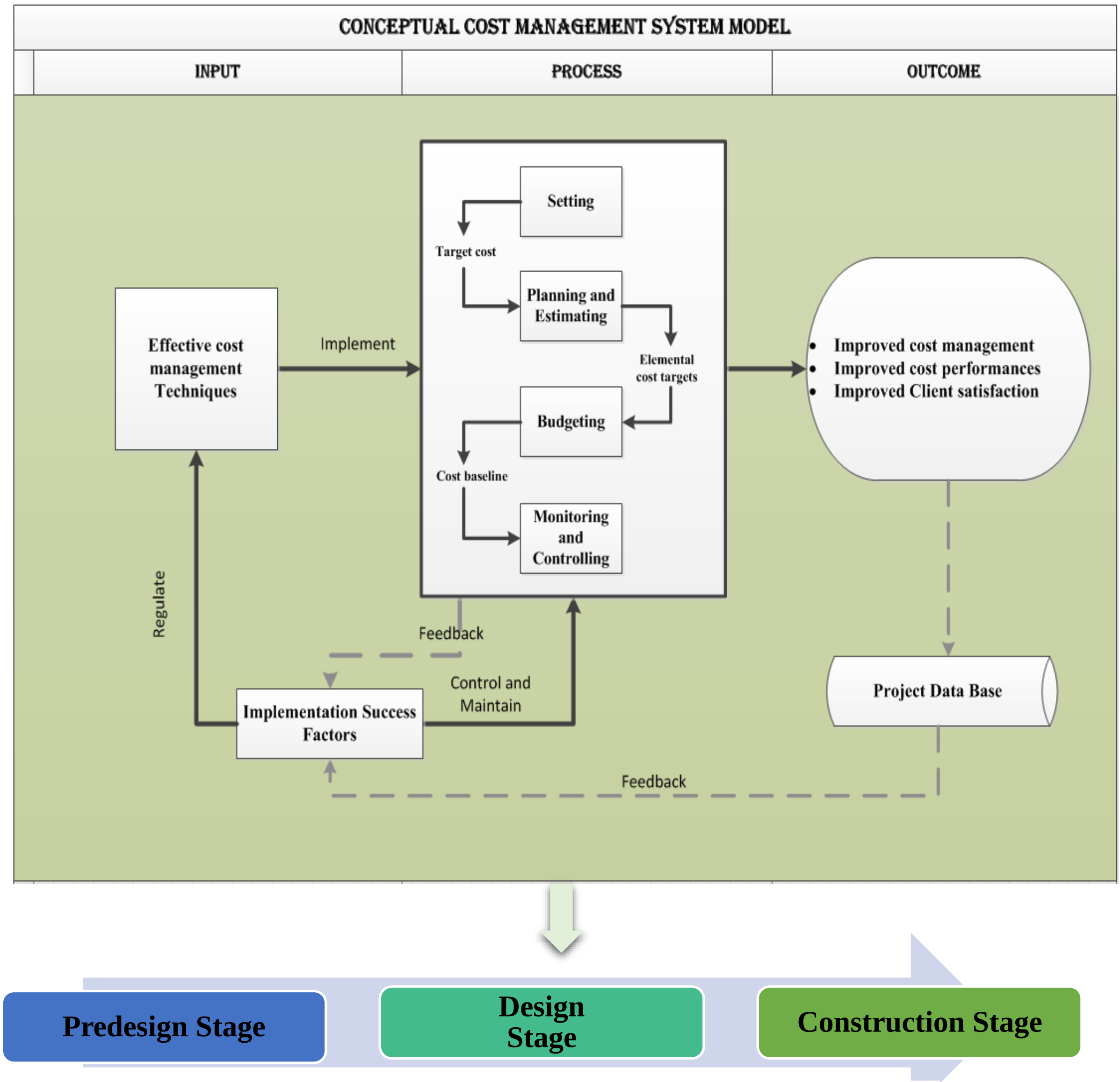
A critical review of the three models/ framework show some areas of strength and weaknesses. The LcH project cost management framework succeeded to detailed some of the techniques processes and IMSF drivers in a CMS reflecting the project delivery stages. However, it failed to distinguish the system input from process or highlight their relationships and the success factors to maintain effective implementation. In addition, the study was conducted over a decade ago which suggests the need for a more recent study to reflect any developmental change in recent years to reflect the current approaches and strategies employed in practice in Nigeria. The integrated CMS model was quite impressive as it covered project cost management from predesign to construction stages. It highlights the techniques and process however lacked the representation of the IMSF. As such, it presupposes that the model users may not be certain of the factors that need to be put in place to effectively implement the techniques within the process. Finally, the Target costing framework detailed the implementation of TC at the setting and planning stages of the CMS process. It also identifies the IMSF drivers for its effective implementation. However, the model is not comprehensive as it is limited models only one technique to operations at first two stages of the process.

This review suggests that the models are developed based on the identified contextual problems the researchers sought to address. As recommended by Charoenngam and Sriprasert (2001), an effective CMS ought to provide updated information about various aspects of project cost performance to aid decision support for all levels of management during construction. Findings from studies by Kern and Formoso (2006) and Jacomit and Granja, (2011) demonstrated the need for continous improvements in CMS for LcH project deliver for improved cost performances. They further recommended that studies on CMS will require implementation studies to develop appropriate and applicable theories for CMS by examining the perculiarities in the specific context of use. Obviously, this is one of the reasons why a study aimed at developing a system for improved cost management on LcH projects in the Nigeria is expedient.

2.9.5 Need for a Comprehensive CMS Model for LcH Project Delivery in Nigeria

Previous sections have identified poor project cost performances as a problem facing LcH project delivery in Nigeria. Recommendations are that employing an effective CMS can be viable gateway to improved cost performances on LcH projects. Therefore, following the peculiarities of LcH project delivery, an appropriate CMS should possess effective techniques appropriately employed in a proactive management process approach with due consideration on the key IMSF that will facilitate successful implementation. However, literature findings suggest a lack of appropriate contemporary CMS models effective for LcH project delivery particularly in the Nigerian context. Though it could be argued that the framework proffered by Oladapo (2001) is applicable, however the framework did not model the structure and relationships of the elements of the CMS (technique, process and IMSF). Furthermore it has been developed over a decade and is not seen appropriate for contemporary practice in LcH project delivery. In view of this, a more comprehensive model that can improve on the limitations of existing CMS models. Therefore, a model that shows the interrelationships among the elements of the CMS and how the process can be effectively implemented can be more useful to the PMT in effective LcH project cost management. Such model will assist the PMT towards effective cost performances of LcH projects in Nigeria.

The conceptual cost management system model (CMSM) that this study will develop seek to provide a holistic picture of techniques, process approach, and key IMFS appropriate to drive effective cost management on LcH projects. The CMSM is a structural and process model, which provides a clear understanding of the interactions between the techniques, IMSF and process. Through this conceptual model, it becomes viable to see the relationship between the techniques, process, IMSF and outcome. Therefore, based on the literature findings, it is the researchers initial thought that the relationship within the various components of the CMS can be represented in the CMSM as depicted in Figure 2.18. The CMSM represents the technical, process, control and outcome subsystems. The technical system embodies the effective techniques, the process subsystem the operational stages and the control subsystem the IMSF and associated drivers. The techniques and IMSF feed into the process parameter. The operational process stages interacts constantly with the techniques and the IMSF to achieve the performance pointers. This achievement will lead to improved system outcomes. It is expected that this conceptualisation of the CMS avails the researcher the opportunity to evaluate the relationships of the various subsystems within contextual settings.



Low-cost Housing Project Environment

Figure 2. 18: Conceptual model- Initial thought

The conceptualisation of the CMSM components evolves certain research propositions that needs testing in the course of this research process. Research propositions are a simple set of relationships telling a hypothetical story of why such events occur (Yin, 2012, p.9). The research propositions to be tested are as follows:

- Ineffective CMS influences poor cost performances of LcH projects.
- The choice of techniques and process approach influences the efficacy of the CMS to achieve expected performance outcomes.
- The current CMS need both technical and implementation improvement for effective outcomes.
- Certain IMSF are pivotal to maintain effective and viable CMS implementation.
- A comprehensive CMS model can improve LcH project cost management and performances in the Nigeria.
- The CMSM can assist project management teams to achieve effective cost management and performances in LcH project delivery in Nigeria and especially the southeast zone.

2.10 SUMMARY OF FINDINGS FROM LITERATURE

This chapter has examined the concept of LcH project delivery, project cost performances, CMS, and IMSF from extant and related literature. In this regards, certain findings have emerged which will form the platform of existing themes for further investigations in the research process.

2.10.1 Effective Cost performance in Low-cost Housing Project Delivery

LcH is mainly a government-initiated scheme particularly in developing countries to meet the housing need of a particular population class, low and lower-middle-income group. Literature findings indicate that this housing type will remain a highly demanded product in the housing sector for many years to come particularly in a country like Nigeria following contextual characteristics. It was also found that effective cost performance is one of the prioritised success criteria for successful LcH project and provision in many developing countries especially Nigeria. This criterion in LcH project delivery in Nigeria is seen as a major factor in realising viable and successful LcH provision across the country. Furthermore, poor cost performances prevail as one of the significant issues challenging successful LcH project delivery in both Nigeria and across the globe. The review showed that the causes of poor cost performances are traceable to managerial ineffectiveness, such as employing ineffective cost management systems. Based on the above, effective cost performance is highlighted as a theme for further investigation in the study context.

2.10.2 Cost Management System Characteristics

An examination of the literature on CMS reveals some valuable characteristics. The CMS is categorised under headings of conventional CMS and modern CMS. Findings indicate the conventional CMS appear more popular in use than the modern CMS. However, given achieving effective cost management and performances, the modern CMS is more effective. Whereas there has been a continued decreasing trend in conventional CMS usage on projects in developed countries, developing countries, particularly in the African region, still prefer to adopt this system. This preferred adoption is in spite of its inability to deliver effective cost performances.

The CMS is characterised by three main subsystems namely the technical (techniques) process (operational stages), control (IMSF) that lead to an eventual outcome. Ten commonly cited effective techniques categorised under the headings of conventional and modern. It was also found that there is a relationship between CMS and project cost performances. Conventional CMS are found to be in popular use especially in building project delivery in many developing countries. However, it is found that the results on cost performances have not been most favourable. However, the existing studies carried out on CMS for project delivery especially in developing countries is an enormous scope of analysis where every country is lumped together (Chigara et al., 2013). Therefore, this research focuses on LcH project delivery in Nigeria as a country to see if similar findings will result and proffer most suitable solutions.

2.10.3 Need for Implementation Success Factors

An effective CMS will influence effective cost management and performance outcomes in LcH project delivery. Hence, the effectiveness of the CMS depends to a great extent on the choice of techniques, process approach, and consideration of the IMFS. Findings show that many studies in the field of project cost management focus on the technical and process component of the CMS recommending improvements with rare consideration in the area of IMSF. Literature review indicates limited studies on IMSF in CMS and particular on LcH project delivery. This component is described essentially to improve the efficacy of CMS implementation. Generic studies apparently, team and management related IMSF as essential for effective management and performance. Thirteen drivers associated with the team, management, and external IMSF were identified from the literature. However, the relationship between these elements in achieving the process performance pointers is not explicitly addressed. Although these drivers could be tangential for effective CMS implementation, there is need to confirm the applicability of these drivers subject to further contextual investigations and verifications in this research.

2.10.4 Need for Effective CMS Models for LcH Project Delivery

Findings show that LcH project CMS models are evolving with contemporary cost management practice. However, many of the CMS models examined are more focused on technical improvement and do not clearly represent the relationship of IMSF in the process. In the Nigerian context, models on CMS are rare. Existing CMS model found was developed over ten years ago and may not be appropriate for contemporary cost management practice. Therefore, to improve cost management and performance outcomes on LcH project delivery in the Nigeria, a comprehensive model that represents the relationship between the techniques, process, and IMSF is needful. This model can assist the PMT to improve cost management practice on such projects.

2.11 CHAPTER SUMMARY

This chapter has provided a working definition for LcH, LcH project delivery, and CMS. It gave an account of the place of LcH in the Nigerian housing sector. Furthermore, the chapter discussed and duly considered poor cost performance as an underlying factor challenging effective LcH project delivery. It also discussed the relationship of CMS and cost performances. Besides, the components of the CMS, techniques, process and IMSF received considerable attention. Based on the reviews in this chapter, there was an outstanding support for studies that proffers strategies to improve project cost management and performances outcomes. Therefore, it is expected that the researcher would identify the characteristics of CMS in current use and examine its efficacy on project cost performances. This investigation is with the view of identifying areas of improvement and conceptualising a comprehensive CMS model.

This chapter has successfully reviewed these core concepts in this research and the theme emerging from literature that needs further contextual investigations. The subsequent chapter proceeds to discuss the research methodology adopted in the conduct of the study towards the attainment of the research aim and objectives.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1. INTRODUCTION

The previous chapter discussed and documented a comprehensive review of literature based on the concepts examined in this study. This chapter discusses and clearly present, the systematic methodological procedure adopted in this research and rationale behind the choice. For simplicity and clarity, this chapter is structured as follows:

- Review of initial motivation and need for research methodology
- Justification of research philosophy, approach, and strategy
- The case study design
- Data collection and analysis techniques
- Credibility of research findings
- Chapter Summary

3.2 REVIEW OF INITIAL MOTIVATION AND CONCEPT OF RESEARCH METHODOLOGY

Research is a systematic and careful inquiry or an examination to discover new information or relationships and to expand and verify existing knowledge for some particular reason(s) (Smith &Dainty, 1991). According to Saunders et al (2012) and Collis and Hussey (2003), the purpose of research could be descriptive, exploratory, explanatory, investigative, or predictive as (Table 3.1).

Table 3. 1: Purpose of Research

s/n	Purpose	Reasons
1	Descriptive	To inform about the status of an occurrence,
2	Exploratory	To gain insight into a problem where there are limited earlier investigations,
3	Explanatory	To clarify how and why an occurrence exists in order to proffer solutions
4	Predictive	To forecast the tendency for a similar situation in a particular context to occur elsewhere.

Source: Compiled from studies by Saunders et al. (2012) and Collis and Hussey (2009).

However, Saunders et al. (2012) noted that there could be possible reasons for a combination of more than one research types in a single study. They also espoused that a research on a particular area of interest often evolves because of the researcher's experiential knowledge, an extensive review of literature or both. In this context, the investigator's experiential knowledge is a product of personal experiences or observations about a particular phenomenon. The initial motivation for this PhD research is a result of the researcher's interest in construction project cost management and past involvement in cost management practice of housing project delivery in the Nigerian southeast zone. Furthermore, evidence from scholars in academia and industry have expressed concerns on the high incidence of poor cost performances of many public sector projects including LcH projects. This problem has negatively affected the value expectations of project sponsors. It has also challenged the reputation of the PMT and potential benefits to the end-users in Nigeria and especially the southeast zone. Therefore, the PMT need to adopt viable strategies to overcome this problem in LcH project delivery.

Studies (Kern &Formoso 2006; Jacomit & Granja 2011; Obi & Arif, 2015) identified an effective CMS as one of the viable strategies to improve project cost management and performance. Surprisingly many scholars have apparently not attempted to examine the CMS with a view of proffering appropriate systematic models for LcH project delivery in developing countries such as Nigeria. Therefore, the researcher seeks to explore the characteristics and efficacy of the CMS in current use on the LcH projects as a proactive step to an appropriate and well-developed CMSM. Developing the CMSM will require an understanding of the contemporary structure of how project costs are managed why they are unable to influence effective cost performances. Also, identify areas of constraints in the CMS, and adopt possible improvement approaches. Based on these reasons, the research can be considered both exploratory and explanatory.

Consequently, adopting an appropriate research methodology is essential to meet set objectives. Research methodology refers to the overall process employed in research from theoretical underpinnings to the collection and analysis of data to arrive at a credible result(s) that informs or improves the study of a phenomenon (Crotty, 1998). Therefore, it embraces not only the research strategy or methods but also the logic behind their choice. Several researchers adopt various nomenclatures within research methodology literature that could be conflicting and confusing to the readers. For instance, the term research strategy as used by Saunders et al. (2012) connote a different meaning in the context of kagioglou et al. (1998) study. For better clarity, this study adopts the terms used by Saunders et al., (2012), to describe the various research methodology elements (Figure 3.1).

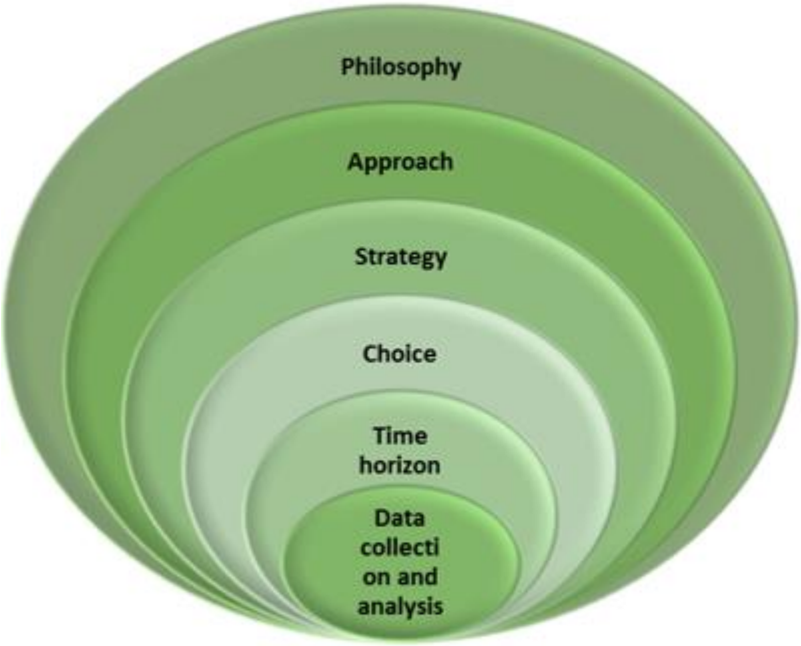


Figure 3. 1: Research Onion

Source Adapted from Saunders et al., (2012)

3.3 RESEARCH PHILOSOPHY

Research philosophy is a term relating to the development and nature of knowledge embracing assumptions worldviews from different standpoints (Saunders et al., 2012). According to Holden and Lynch (2004), it informs the predetermined assumptions concerning inter-related concepts on a phenomenon. (Kagioglou et al., 1998). Easterby-Smith, et al. (2008), noted three main reasons for understanding research philosophy. These include the provision of clarity in the research design, recognising the appropriate design. Therefore, an understanding of research philosophy is the first step towards making appropriate choices and decisions in the research process.

Past literature establishes two main philosophical positions: positivism and interpretivism though these taxonomies could differ in some texts, though, some studies also highlights realism and pragmatism (Saunders et al., 2012; Creswell, 2015). However, a careful review of literature in research philosophy link realism and pragmatism with the main platforms of positivism and interpretivism. Hence, drawing from general debates on worldviews, the concept of positivism and interpretivism is seen foundational, and this study explores them to explain and gain a better understanding of the philosophical position of this study. However, there is need to define the three areas of assumptions namely ontology, epistemology and axiology (Easterby-Smith et al., 2008; Saunders et al. 2012) to gain a clear understanding of positivism and interpretivism.

3.3.1 Philosophical Assumptions

There are three philosophical assumptions ontology, epistemology, and axiology. Ontology according to Crotty (1998) is the study and science of being, concerned with what forms reality. According to Bryman, (2004 p. 16), it is concerned with *"…questions on whether social entities should be considered external entities that have a reality external to the social actors, or … considered social constructions that can be built up from the perceptions and actions of social actors."* Saunders et al. (2012) identify two continuums of objectivism or subjectivism with the former independent of social actors and the later more dependent. Therefore, this assumption is concerned with the concept of reality, which exists dependent or independent of the social actors.

Epistemology is the second philosophical assumption. It is concerned with what type of knowledge is possible and how to ensure that it is both adequate and legitimate (Maynard, 1994). It defines the way we gain understanding and explains how we know what we are aware (Crotty, 1998). It is also the study of knowledge, based on what is expected to be valid and acceptable knowledge in a field of study and involves the examination of what is being researched about the researcher (Collis & Hussey, 2009; Saunders et al. 2012). Concisely, epistemology defines what knowledge is, how knowledge is acquired, and how knowledge can be justified or reasonable.

Axiology is the third philosophical assumption that deals with the judgments of value and its importance to the credibility of the research results (Saunders et al., 2012). Research is not 'neutral' but reflects a range of the researcher's personal interests, values, capabilities, assumptions, purpose, and ambitions. Heron and Reason (1997) argued that values are the guiding reason of all human action and the axiological skill to articulate values as a basis for making judgments are essential in every research. Saunders et al. (2012) identify two continuums of axiology value-laden and value free. A study is value-free when the researcher conducts the study independent, neutral, and objective not interfering with what is being investigated while value-laden is vice versa.

Saunders et al. (2012) summarise the concept of the three assumptions under two continuums of objectivism or subjectivism (Table 3.2). Therefore, the ontological, epistemological and axiological assumptions of a research determine its philosophical position. The position could be positivism or interpretivism.

Table 3. 2 Research assumptions and continuums

Assumption Type	Concept	Continuums	
		Objectivism	**Subjectivism**
Ontology	Nature of reality	External, One true reality	Socially constructed, Multiple realities
Epistemology	Knowledge	Facts Observable phenomena Law-like generalisations	Individual and context specific Opinions Attributed meanings
Axiology	Role of Value	Value free Detached from the research	Value laden Integral and reflexive

Source: Adapted from Saunders et al. (2012)

3.3.2 Positivism

This worldview assumes that reality exists independent of the mind and believes that truth needs to be measured objectively through examination of empirical regularities and deductive tests. Its end product is a law-like generalization similar to those of the natural science (Tan, 2002; Saunders, et al., 2012). Positivism is the view that things exist as meaningful realities independent of experiences and attaining the truthful meaning is based on careful scientific research on objects with the researcher with the research detached from what is being researched. Therefore, this philosophical position adopts an objectivism ontological, epistemological and axiological assumption.

3.3.3 Interpretivism

Interpretivism argues that studies involving human influences or interactions cannot be treated as objects. It maintains an ontological assumption that reality is created from interpretations based on the perception and consequent actions of the social factor. Interpretivism gives details of rich insights into the phenomena investigating subjective meanings to gain information behind the reality of events. Views by Collis and Hussey (2003) and Saunders et al., (2012), clearly suggests that interpretive view of reality is somehow confined to the mind based on ideas and is socially constructive. This perspective shows that the researcher interacts with what is being researched (Remenyi, 1998; Saunders et al., 2012). This position, therefore, acknowledges that the interpretations of the perceptions of people rather than object on a phenomenon determine reality hence measured subjectively.

3.3.4 Philosophical stance of the study

The nature of reality and knowledge creation considering aim and initial impetus for this research cannot be objectively sought. This study explores the characteristics and efficacy of CMS in current use, which will rely on the opinions, and experiential knowledge of the PMT members. The PMT is responsible for the choice and implementation of the techniques and processes in the CMS. Hence, reality is created by interpreting their perception and following actions. Hence, the ontological assumption of this research leans towards subjectivism.

Furthermore, improving the CMS outcome on cost performances of LcH projects in the Nigeria will involve gathering information from the PMT responsible for the cost management practice on these projects. Therefore, constructing knowledge required to develop the CMSM will generate more than one view from their perceptions requiring more evidence for support. Such investigations provide rich details with reliable references that require the collection and analyse of both qualitative and quantitative data sets. Hence, indicates the researcher interaction with what is being researched. As a result, this study is not concerned with an observable reality and search for regularities and relationships with the end product being a law-like generalization similar to those of the natural science as in positivism but integrates different perspectives of social actors to help interpret data (Crotty, 1998). Hence, the epistemological assumption of this research leans towards subjectivism.

On the axiological perspective, given that, the researcher has a piece of knowledge, and previous experience in the area of project cost management her input will assist to construct the views gathered from the PMT. This input into the investigation makes the researcher Integral and reflexive. Therefore, the research leans towards a value-laden axiological position.

Based on the ontological, epistemological and axiological perspectives of this research, it is clear that the research leans towards an interpretivism philosophical position. This worldview will influence its research approach, strategy, and methods as will be later discussed in the succeeding sections in this chapter.

3.4 RESEARCH APPROACH

Saunders et al. (2012) defined research approach as the process through which theory is developed. It is the logic through which knowledge claims are established (Creswell, 2003). Conventionally research approach is categorised into the deductive and inductive approach. However, the abductive approach has evolved following the views by scholars (Dubois & Gadde, 2002; Collis & Hussey, 2003) that incorporating elements of both deductive and inductive approaches will improve result credibility. These approaches are further discussed.

3.4.1 Deductive Approach

Dubois and Gadde (2002) stated that the deductive approach is concerned with building a hypothesis from an existing theory and testing it. This approach usually places emphasis on a quantitative route with measurements and observations and collecting data based on predetermined instruments that yield statistical data. Its process originates from a definite and tentative set of hypotheses. The conceptual and theoretical framework is tested using structured or a well-controlled series of empirical observations to collect and analyse numeric data to aid explanation of a particular phenomenon or confirm a theory (Collis & Hussey, 2003; Saunders et al., 2012). Thus, knowledge claims are positivist in nature.

3.4.2 Inductive Approach

Dubois and Gadde (2002) stated that whereas the deductive approach is concerned with building a hypothesis from an existing theory and testing it; the inductive approach is concerned with generating a theory from the collected data and analysed. The inductive approach is particularly concerned with understanding the context in which the events are taking place. Thereby it provides insights into the setting of a problem, to generate ideas, propositions, and hypotheses. These can be later evaluated using a quantitative research to uncover underlying motivations, relationships, and factors that influence decision making and opinions. Therefore, it adopts strategies that involve the collection and analysis of non-numeric data to interpret and construct meanings and are subjective as it focuses on values, attitudes, and opinions.

3.4.3 Abductive Approach

This approach incorporates the elements of both deductive and inductive approaches and resides in the middle of the continuum (Dubois & Gadde, 2002; Collis &Hussey, 2003). Saunders et al. (2012) described the abductive approach has evolved from the constraints of the lack of the best suitable single approach to examine, explore, or explain relationships among variables in a particular situation. It involves the process of moving from theory to data (deductive) and data to theory (inductive) (Saunders et al., 2012). Kovács and Spens (2005) stated that this approach could be used to match, extend, or develop a framework based on new constructs of meanings that apply to the real life situations. One of its advantages is the ability to adapt both qualitative and quantitative methods within a single study and further allows expansion and triangulation that can overcome the potential criticism of a single approach (Denzin, 1970, cited in Collis & Hussey, 1998). Therefore, the abductive approach is not just concerned with the discovery of new variables and relationships through the utilisation of various concepts found from existing theories, but rather enables an understanding of the phenomenon being studied to develop a contextual theory.

3.4.4. Research Approach for the Study

Gaining practical insights to understanding the problem areas are a necessity to develop contextual solutions to the problems identified. This study is such that there is a paucity of relevant literature on CMS in LcH project delivery, particularly in Nigeria. Some literature that does exist is only tangential to the problem under consideration and does not provide an adequate background to aid ready insight into the CMS employed on the projects. Likewise, existing models on CMS from literature in LcH project delivery in other countries cannot be tested without a previous understanding of the peculiarities in the study context. It follows then that the approach cannot be definite and can adopt either the deductive or inductive approach.

This study is not concerned with testing an existing CMS model in context. Rather examine relationships between elements in the CMS through the utilisation of concepts found from existing studies, to enables an understanding of the problem and developing an appropriate contextual solution. Therefore, the abductive approach will be more suitable for the study. It starts with a review of the literature supporting the conceptual ideas and propositions (deductive approach) followed by investigations of the findings in real life situations (inductive approach). This process gives the researcher insight into the CMS for LcH project delivery and settings of the problem. Relevant information will be gathered on the CMS (techniques, process, and IMSF) based on the perception and values of the PMT involved providing answers to the research questions and propositions. The findings will facilitate the generation of practical ideas for improvement of the CMS and the development of the CMSM.

3.5 RESEARCH STRATEGY

A research strategy is defined by Denscombe (2010) as a plan of action, process, or design lying behind the choice and use of particular methods. It links the choice and use of methods to the desired outcomes. Research strategy informs the methods, by which relevant information will be collected and analysed (Crotty, 1998). Evidence show that no particular research strategy is inherently superior or inferior to the other; therefore, it can be quite possible to adopt a combination of the strategies (Saunders et al., 2012). Literature document some commonly used research strategies such as survey, experiment, case study, mixed method research, ethnography, archival, grounded theory and action research (Yin, 2009; Denscombe, 2010), Saunders et al., 2012: Creswell, 2015). These strategies are discussed in more detail in the next section of this chapter.

3.5.1 Types of Research Strategies

Five main research strategies are extensively discussed in literature though there are several others. An overviews of these five strategies are presented:

- *Experiment* as a research strategy is associated with quantitative studies and applied to explain a causal relationship between variables. This strategy is usually adopted for research in the natural sciences. It adopts predictions (hypothesis) rather than research questions and a deductive approach to testing existing theory to confirm or reject it (Saunders et al., 2012). It is usually carried out in a controlled and structured environment for which the variable can be manipulated (Yin, 2009; Denscombe, 2010; Saunders et al., 2012).
- *Survey strategy* is also associated with the quantitative studies. It is adopted where a large amount of data is required to describe and explain a phenomenon rather than explore the context of the phenomenon and can also be used to support other strategies (Yin, 2009; Collis &Hussey, 2003). Like experiments, it adopts the deductive approach and can be used to answer questions for what, where, how much, and how many, which may be used to collect numeric data.
- *Case study* as a research strategy can be adopted in both qualitative and quantitative research. According to Patton and Appelbaum (2003, p. 67), the aim of case studies is to "*uncover patterns, determine meanings, construct conclusions and build theory*." The peculiarity of this strategy is the identification of the case to be studied which can be an individual, an event, process or entity (Yin, 2009). It is mostly adopted in exploratory research and can apply to descriptive, illustrative, experimental and explanatory

research (Yin, 2009; Denscombe, 2010) to answer research questions on how, what and why. It also involves the extensive study of a single instance of a phenomenon of interest and is concerned with understanding the dynamics that exist within a particular setting (Collis & Hussey, 2003; Yin, 2009). Eisenhard (1989) espoused that a case study begins with a deductive approach and moves on to an inductive approach to build a theory. One of the great strengths of case studies as compared with other strategies flows from its strengths to collect multiple sources and chain of evidence. This evidence allows for triangulation (evidence from different sources to corroborate the same fact or finding).

- *Ethnography* is a research strategy strongly associated with the qualitative research approach that evolved from anthropology, which seeks to study individuals, groups and their culture, lifestyle perceptions and beliefs. It seeks to explain the naturalistic social world from the stance of those involved (Denscombe, 2010; Fetterman, 2010). Saunders et al. (2012) stated that it is "used to study groups." Consequently, the researcher becomes a working member of the group or situation being studied and shares the same experience as the subjects with the aims of providing details on difficult realities to explain the phenomenon.
- *Archival research* as a strategy employs the use of administrative documents and records as the main source of data for explanatory, descriptive, and exploratory research (Yin, 2009). Bryman (1989, cited in Saunders et al., 2012) stated that although archival connotes historical, recent documents can also be studied. This strategy further allows for research questions involving history and changes over time to be answered. However, this strategy relies on secondary data and where problems of lack of access arise this can be a major constraint to the research.

Other types of strategy identified from the literature include *Action research* in which the researcher intervenes to monitor, evaluate and influence change within a given setting. It is research in action within an organisation to improve the methods and approach of those involved in the development of a theory or transfer of knowledge (Saunders et al., 2009; Yin, 2009). *Grounded theory*, is also another strategy which enables the development of theories and explains social interactions and processes to theory building, adopts an interpretive process, and requires a tactic knowledge and feel for data collected (Suddaby, 2006, in Saunders et al., 2012). Yin (2009) highlighted some strategies appropriate to address the type questions posed, control of behavioural events and focus on contemporary events (Table 3.3).

Table 3. 3: Choosing a research strategy

Strategy	**Form of research question**	**Requires control of behavioural events**	**Focuses on contemporary events**
Experiment	How, why?	Yes	Yes
Survey	Who, what, where, how many, how much?	No	Yes/No
Archival analysis	Who, what, where, how many, how much?	No	Yes
History	How, why?	No	No
Case study	How, why?	No	Yes

In this research purpose,

- Research questions focus on what, why and how CMS influences cost performances in LcH project delivery in Nigeria.
- Investigation: focuses on the current events of poor cost performances in LcH project delivery in Nigeria
- Investigation will require no control of behavioural events

Therefore, it is apparent from the above considerations that this research is an investigation into a contemporary event focused within a contextually bounded area (study scope) and requires no influence or control of behavioural patterns and attitude of those expected to participate in the study. It is research on a natural occurrence that investigates facts, relationships, and processes within the CMS to understand how the system can be improved for better cost performances. Therefore, it will require, collecting and analysis quantitative and qualitative viewpoints which a case study strategy will appear most appropriate to provide. Therefore, adopting a case study will be most suitable.

3.5.2 Case Study as the Adopted Research Strategy

Denscombe (2010) argued that by principle, a case study aims at revealing a general problem by exploring a particular instance. The case study is a strategy associated with both qualitative and quantitative research and involves an empirical investigation into particular present happenings within a real life context using multiple sources of evidence such as interviews, observation, document, artefacts, and questionnaires that can form the basis for scientific generalizations. Besides, it can combine both numeric and non-numeric data in its procedure; hence, flexible, for quantitative, qualitative and mixed-method research (Yin, 2009; Denscombe, 2010; Saunders et al., 2012). The issue of poor cost performances is endemic in LcH project delivery. Although a plethora of study investigates poor cost performances in LcH project delivery in Nigeria, studies on project cost management in this context is rare. Found studies that attempted to proffer a framework was Oladapo (2001). Given the gap in the literature, an in-depth investigation on CMS in LcH project delivery using a case study will bring to light the characteristic of popular CMS employed for LcH project delivery in Nigeria. It will also reveal why the systems are not able to deliver effective cost performances. The findings will assist the researcher to identify contextual measures necessary to improve the efficacy of the systems in use and aid analytical generalisations needed to conceptualise a CMS model appropriate and applicable for LcH project delivery in both the southeast and Nigeria.

3.5.2.1 Case Study Design

As noted by Yin (2009), a case study can adopt either a multiple or single case study design. Yin (2009) expressed that the reasons for the case study could be that the case is critical, unique, revelatory, typical or longitudinal. A single case study design is a study of a contemporary phenomenon in a particular context. This type of design is suitable to investigate cases that are revelatory, extreme exemplars, or opportunities for unique research access. On the other hand, in multiple case study designs, the interest is clearly of the phenomenon and not the case. The cases are only examples to understand the phenomenon (Yin, 2009; Thomas, 2011). Both single and multiple -case study designs can richly describe the existence of a phenomenon, and as a base for theory testing or building, though, multiple-case study designs can provide a stronger base.

In this study, both single and multiple case study designs are applicable. However, the choice of a single case study design is considered most appropriate for the following reasons:

- The issue of poor cost performances in LcH project delivery in Nigeria is a typical problem across all the zones. This issue affecting LcH project delivery is typical across all the various zones in the country and particularly in the southeast zone where it has contributed to the poor housing situation (Ubani et al., 2013; Okoye et al., 2015). Therefore, picking one and conducting an in-depth investigation in the CMS for LcH project delivery in one zone will produce more in-depth qualitative data than having multiple and superficial case studies of all the zones. As earlier discussed in section 2.5 LcH projects are prototype buildings and projects that have same identical characteristics and physical structure. Therefore, there are no significant differences in the features of LcH project delivery in the country. It is the view of this research that a choice of one of the zone experiencing poor cost performances in LcH project delivery such as the southeast zone will yield the necessary results that can be generalised analytically within the context of Nigeria. On this platform, a case study of poor cost performances of LcH project in the Nigerian southeast zone will be conducted, the phenomenon of interest is the CMS for LcH project delivery and its relationship with the project cost performances.

Further justifications for choosing the single case study is discussed using the headings suggested by Yin (2009) for the choice of a single case study design is adopted for a clearer explanation.

- *A critical case*: A single case study is suitable to investigate a critical case to provide a platform to test a set of propositions, and allow theory development refinement and confirmation. Nigeria is one of the countries where poor cost performances are a serious problem and can sometimes exceed 100 percent cost overruns. The problem is said to be more severe in LcH projects affecting housing output in Nigeria and especially in the southeast zone. The particular area of interest about the research questions investigated is the CMS relationship with poor cost performances. Improving cost performances in LcH project delivery in Nigeria and especially the southeast zone is also founded in improving the efficacy of CMS employed. Therefore, it is necessary to investigate the cause of ineffective CMS by capturing its characteristics, effectiveness and identify areas that need improvement. This investigation will allow the test of a set of propositions and a well-developed model (CMSM). This model will help achieve effective LcH project cost performances in both the southeast zone and Nigeria which is a contribution to knowledge.

- *A revelatory case:* Many studies on LcH project cost performance in Nigeria have identified ineffective CMS as one the factors contributing factors. However, they have not attempted to understand the reasons why the CMS employed are ineffective. Examining CMS within the context of LcH project delivery in the Nigerian southeast zone as a case study will reveal the inherent characteristics (techniques, process approach IMSF) and efficacy of the system. The revelation from the investigation provides a platform for developing appropriate systematic solutions.
- *A longitudinal study:* Single case study design is appropriate for longitudinal studies. A study to improve the CMS for LcH project delivery is a longitudinal study because of changes in contemporary practice. Therefore, no one model can be considered permanent. As part of a longitudinal investigation, this research seeks to improve the CMS outcomes, by developing the CMSM for LcH project delivery. Though, this model needs to be tested over a period to ascertain actual impact in real-life situations. However, this testing could not be achieved given the duration of the PhD programme but, employs expert validation via structured and semi-structured interviews as an alternative to overcome the limitation. It is expected that subsequent studies will test the CMSM on life projects to refine the model where applicable.

3.5.2.2 Background to the Nigerian southeast zone as the case study area

The Southeast zone is located in the south eastern area extending from latitudes 4° 40’ to 7° 20’ north latitude and 6° 00’ to 8° 20’ East longitude. The zone covers the bulk of the Igbo speaking ethnic territory in the country and zone was once known as the East central state its history dates back to the creation of Imo state and Anambra state in 1976 from the old East Central State. Following a re-organisation in 1991 Abia was created from Imo state and Enugu from Anambra state. In 1996 another state Ebonyi was created from parts of Enugu state and Abia states. These five states constitute the southeast zone (Figure 3.2). In comparison to other zones in Nigeria, the southeast zone is by far the smallest, accounting for mere 3.2% of the national space. Abia, Anambra, Ebonyi, Enugu and the Imo States each account for an area of 6230 km2, 4844 km2, 5530 km2, 7161 km2, and 5530 km2 respectively.

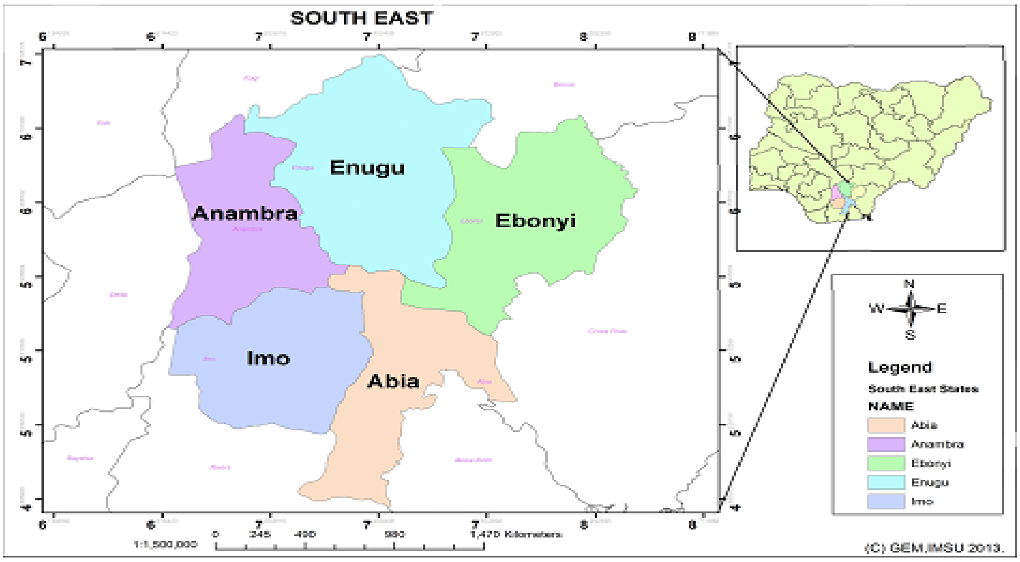


Figure 3. 2: Geographical Map of Nigerian Southeast zone

Source: Adapted from Ekong, at al. (2012).

The Nigerian southeast zone possess many natural resources. Crude oil, natural gas ceramic, zinc and agricultural produce like yam, maize, potatoes, rice, cashew, plantain and cassava, salt deposits, natural gas, crude oil, coal and ceramics, lead, and zinc are some of the natural resources the zone contribute to the national economy. It also houses the largest commercial city in Africa and industrial markets in Nigeria and is an important contributor to the national economy because its principal cities are industrial and market centres in Nigeria. The construction sector also thrives from the national resources obtained and supplied from this zone. The zonal population according to the 2006 census data reports is 16.4 million people, which is about 11 percent of the national population (Table 3.4).

The 2012 Annual abstract of statistics in NBS (2015), estimated the total population to be about 19 million persons. According to the report, the population density in the southeast zone is nearly four times the national average.

Table 3. 4 : Population of the Nigerian Southeast Zone

States	Population (2006 census)	Households (2006 census)
Abia	2,845,380	605,987
Anambra	4,177,828	882,875
Ebonyi	2,176,947	449.709
Enugu	3,267,837	725,767
Imo	3,927,563	837,195
Total zone population	16,395,555	3,052,274
Percentage of country	10.99	10.82
Total Nigerian Population	149,229,090	28,197,085

Source: Compiled from National Bureau of Statistics (NBS) (2015)

This density is in spite of the statistical report that show is, high net migration, associated with residents of the zone. Statistics records that up to 15 percent of the persons born in the area live outside the zone and only 5 percent of the residents are from other zones. The population works as farmers, traders and civil servants and a vast majority of the population in the zone by income group classification, are predominantly within the low and middle-income group. Analysis of the Percentage distribution by household monthly income across the zone (Table 3.5) which shows that more than 90 percent earn a monthly income ≤ N47,268 (£ 156).

Table 3. 5: Percentage distribution by Household monthly Income

States	Percentage distribution by Household monthly Income (≤ 156 per month)
Abia	97.5
Anambra	96.8
Ebonyi	98.2
Enugu	97.0
Imo	98.0
Average population	97.5

Source: Compiled from NBS (2015)

Drawing from assessment studies by Ebie (2012) on household and housing deficits, an assessment of housing deficits statistics in the zone is estimated at 1.87 million units as shown in Table 3.6. This estimate accounts for up to 11 percent of the national deficits despite its population and size when compared with other zones.

Table 3. 6: Household and housing statistics of the Nigerian Southeast Zone

States	Households (2006 census)	Estimated Deficits
Abia	605,987	324,142
Anambra	882,875	475, 933
Ebonyi	449.709	247, 995
Enugu	725,767	372, 268
Imo	837,195	447, 423
Total zone population	3,052,274	1,867,762
Percentage of country	10.82	10.99
Total Nigerian Population	28,197,085	17,000,000

Source: Compiled from NBS (2015)

The endemic of poor cost performances in the housing sector in the Nigerian southeast zone is one of the key problems contributing to poor housing conditions in the zone. Studies (Okoroafor, 2007; Ogbu & Adindu, 2012; Obi et al, 2015) have revealed that this issue has contributed more especially to the low production output and high prices of LcH units making it unaffordable by many projected beneficiaries. Given the income characteristics of the population, many Low and low-medium income groups are compelled to seek substandard accommodations they can afford, leading to rising slums and makeshift shelter across the zone (Duru & Anyanwu, 2014). Therefore, to improve LcH project delivery and provision in the zone, there is an urgent need, for the PMT to be equipped with viable strategies that can address this problem of poor project cost performances.

3.5.2.3 Unit of Analysis

Case studies usually involve the determination of a unit of analysis for which variables are analysed (Collis &Hussey, 2003). The unit of analysis refers to the level of what or who the research questions seek to address (Yin, 2009). It identifies what the researcher wants to investigate within the case study. It is the entity about which data will be collected, and generalisation made (Collis & Hussey, 2003). Remenyi et al. (1998) noted that the choice of the unit of analysis is the platform on which the research question is asked. For instance, if data is collected about the individual, drawing conclusions will be about the individual. In the case where data is collected about the CMS, then generalisations of the findings would be to the CMS. Therefore, correctly identifying a study's unit of analysis is driven by our concern with minimizing errors when drawing conclusions based on our research. In this study, the unit of analysis is the CMS employed in LcH project delivery. Therefore, an investigation into the CMS will cover the identified emerging themes from literature namely:

- the relationship between the CMS and LcH projects cost performances,
- characteristics of CMS employed; techniques and process approach in current use
- Measures (appropriate techniques, process approach, and IMSF) relevant to improve CMS outcomes in LcH project cost performances.

It is on this platform that the CMSM for effective cost management in LcH project delivery will be developed and validated, providing answers to the research questions and propositions.

Yin (2009) and Saunders et al. (2012) pointed out that the unit of analysis can be holistic or embedded. When only a unit is investigated as a whole, it is holistic but embedded refers to examining other subunits to provide a clearer picture of the main unit. To fully understand the characteristics of the CMS employed for LcH project delivery, the CMS used in both federal and state-led LcH project delivery in the Nigeria southeast zone will be identified and investigated. The techniques, process, and IMSF of the CMS will be examined as logical subunits. Therefore, an embedded case study design is adopted. This design would enable the researcher to explore the CMS while considering the influence of the various techniques, process and IMSF on CMS efficacy. However, to gather the needed information on the CMS a careful selection of the case participants is necessary.

3.5.2.4 Case Participants

The case participants are the target entity that provided useful information regarding the unit of analysis. In this context, the case participants are members of the PMT. The choice of the PMT is because they have a direct managerial influence on the cost and are responsible for the implementation of the CMS on LcH projects. The target members of the PMT are the architects, quantity surveyors, engineers and builders acting as project managers, project supervisors, contractor's site manager/supervisors, and consultants. They are expected to will provide information by their organisational/ team role in the cost management process. It is presumed that information obtained from these participants will provide the credible evidence needed for the study to actualise its aim and objective.

3.6. METHODOLOGICAL CHOICE

The methodological choice refers to the procedure for data collection and analysis and could be quantitative, qualitative or mixed method procedure (Saunders et al., 2012). An example of a quantitative procedure is the use of the questionnaires and or empirical experiments and numerical analysis in a single research. A qualitative procedure however, uses semi-structured and unstructured interviews and other non-numerical analysis in a single research. On the other hand, a mixed method procedure combines both qualitative and quantitative procedures. According to Creswell (2015), mixed method procedures is used for the following reasons:

- convergence of results from different sources,
- answering related questions in a complementarily way,
- using one set of methods to expand or explain the results obtained from the use of the other set of methods,
- using one set of methods to develop questionnaires or conceptual models that inform the use of the other set, or
- using one set of methods to identify the sample for analysis using the other set of methods.

This study seeks to explore the CMS in LcH project delivery in the southeast zone to provide an explanation why the system is unable to deliver expected cost performances. Therefore, the questions (what, why and how) posed will require both qualitative and quantitative procedures. Therefore, drawing insight from the posed research questions, and strategy, a mixed method methodological procedure will be most appropriate. The procedure starts with an initial qualitative phase to identify important variables and component relationships within the CMS, followed by a quantitative phase to study the initial qualitative results in more details (leading to the development of the CMSM an emergent theory for cost management of LcH projects in Nigeria. The procedure follows a sequential order Creswell (2003) described this type of sequential procedure as exploratory. Figure 3.3 shows depicts this procedure.

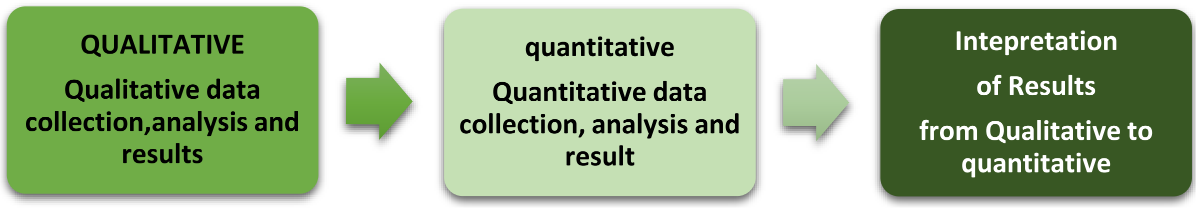


Figure 3. 3: Exploratory Sequential Mixed Method research procedure

Source: Adapted from Creswell (2015)

According to Onwuegbuzie and Collins (2007), Jogulu and Pansiri (2011), and Creswell (2015). This sequential procedure will provide the study with the platform:

- bring together quantitative and qualitative results for a more comprehensive account of the inquiry
- to use results from the qualitative, to develop the questionnaires
- to explain, elaborate and clarify results from the qualitative phase with that of the quantitative phase
- to facilitate rationalised combinations that provide a contextual understanding of the relationship between variables through a survey and external validity

3.7 TIME HORIZON

According to Saunders et al. (2012), time horizon explains how the research would be undertaken within a given time or period. It is viewed from the cross-sectional and longitudinal time horizon. The cross-sectional time horizon denotes a research carried within a given constrained time or snap shots while the longitudinal time horizon is employed in a research that spans over a long period to monitor change and development.

This research will adopt a cross-sectional time horizon for the time required to complete the PhD programme.

3.8 METHOD OF DATA COLLECTION

Data relates to information; evidence implies data in support of questions or propositions (Thomas, 2011). Data is classified either as qualitative or quantitative. Quantitative data includes those data that are termed numeric or countable data while the quantitative data are non-numeric data (Saunders et al., 2009; Collis & Hussey 2009) Data is collected from primary and secondary sources. Primary sources refer to those that are directly collected at field source; while secondary data are those data collected from literature audio or video documents such as textbooks, journals, archives, annual reports, the government published data, and films (Saunders et al., 2009; Collis &Hussey, 2003). This section focuses on how primary data is collected in this research.

Common methods to collect primary data include; observation, questionnaire, interview, document analysis, etc. (Collis &Hussey, 2009: Dawson, 2009). According to Saunders et al. (2012), a method of data collection can be according to the type of data (i.e. qualitative data or quantitative data). Quantitative data collection methods emphasise objective measurements and numerical analysis through statistical means; experiments and questionnaires (Thomas, 2011). On the other hand, Van Maanen (1983,cited in Collis & Hussey, 2003, p.9) noted that qualitative methods are *".....array of interpretive techniques which seek to describe, decode, translate and otherwise come to terms with the meaning and not the frequency of more or less naturally occurring phenomena the social world*." They are, therefore, subjective and involve the collection of data based on the perception of the respondents on an issue.

Quantitative data collection methods emphasise objective measurements and numerical analysis through statistical means. On the other hand, qualitative methods are subjective and involve the collection of data based on the perception of the respondents on an issue. Interviews and focus groups are typical examples. However, the choice of the method whether quantitative or qualitative will depend on the purpose of the study, the resources available, and skills of the researcher

3.8.1 Overview of Common Methods of Data Collection in Construction Research

Literature documents various data collection methods but most common in construction research are observations, interviews, questionnaires and focus group.

3.8.1.1 Observation

This is a process of collecting data whereby the researcher becomes involved by action that can be revealed or concealed in an environment of other people and responds to the way in which the work in such environment is undertaken (Saunders et al., 2012). Observations can be conducted by researcher participating in the process to discover meanings people attach to their actions (Participant observation) or by recording, the frequency at which those actions are performed (Structured observation) (Saunders et al., 2009: Denscombe, 2010). One of its advantages is that the researcher can get to actual information as it is happening. However, the disadvantage is the change of behaviour when the observing sample becomes aware that they are being observed and this may affect the findings

3.8.1.2 Questionnaire

Questionnaire is a quantitative data collection method in which the respondents are asked to respond to the same set of questions in a predetermined order that will be interpreted in the same context by all the respondents (Saunders et al., 2012). The respondents are required to provide answers in same predetermined order Denscombe (2010) espoused that questionnaires are employed to reach a large volume of respondents in many locations. Hence, can be most suitable for descriptive and explanatory research where large samples are needed to ascertain the credibility of findings. Adopt questionnaires will depend on the type of research questions, the number of questions to be asked, and the sample size required for analysis (Saunders et al., 2012; Dawson, 2009). A questionnaire could be either closed, open-ended, or a combination, and may be administered through by hand, telephone, post, or web based (Collis &Hussey, 2009). The questionnaire method offers greater anonymity regarding data collected, facilitates a large volume of information, and can be less time and cost to conduct (Sekaran, 2006).

However, the disadvantages associated with this method is low response rates, lack of detailed responses to a phenomenon and limited opportunities for spontaneous responses.

3.8.1.3 Interviews

An interview is a qualitative data collection method that involves purposeful conversations between two or more persons in which one is referred to as the interviewer asking clear and concise questions, and the other(s) the interviewee(s) who listens attentively and willing responds to the questions asked (Saunders at al., 2012). The interview method allows the researcher to collect data interacting person to person between two or more individuals with a specific purpose in mind (Sekaran, 2006). Interviews are best suited where:

- a study focuses on the meaning of particular phenomena from the perspectives of those involved;
- individual historical accounts are required of how a particular phenomenon developed;
- exploratory work is required before a quantitative study can be carried out; and
- a quantitative study has been conducted and qualitative data are needed to validate a particular measure or to clarify and illustrate the meanings of the findings

Furthermore, interviews can be most appropriate for complex situations, where visual demonstrations are required, and instant feedback is desirable. As a result, interviews can facilitate high response rate, in-depth information and a platform to obtain explanations for questions and further clarifications (Ranjit, 1999). However, it can be time-consuming, expensive, and can only gather information from a limited number of participants (Sekaran, 2006; Saunders et al., 2012). Interviews can be conducted face to face, or via the telephone (Denscombe, 2010; Sekaran, 2006) however, appropriate for the researcher.

As highlighted by Saunders et al. (2012), interviews can be structured, semi-structured, or unstructured.

- *Unstructured interviews* have no planned sequence of asking questions, rather discusses the research area with a series of interviewees to evolve themes that can later be followed up with either semi or unstructured interviews (Saunders et al., 2012).

- *Semi- structured interview* is a more formal interview than the unstructured interview and allows in-depth investigations across some specific topics around which to build the interview (Saunders et al., 2009; 2012). Thus, the list of themes developed by the interviewer linked to the research questions and objectives becomes a guide to ask the questions (Fellows & Liu, 2015). Owing to the degree of structure in its implementation, it allows at least all interviewees to receive some questions in common and gives the researcher the room for flexibility. Semi structured interviews have been identified as the most common type of interview conducted in a small-scale social research because of its advantages.
- *Structured interviews* allow the interviewer to ask predetermined questions as specified in the interview guide. Thus, the same set of questions is asked every interviewee in same order or manner making data analysis easier.

However, the choice of interview type will depend on what the researcher aim to achieve.

3.8.1.4 Focus Group Interviews

Focus group interview is also a qualitative data collection method for gathering relevant information on a subject of research interest based on expert and personal experience of a selected group of individuals assembled by the researcher (Powell & Single, 1996). This method assists the researcher in gathering information for improving a process or as an adjunct to quantitative data collected (Gill et al., 2008). Approximately six to twelve people who share similar characteristics or common interests are gathered in a focus group. A facilitator guides the group based on a predetermined set of topics. One of the benefits of this method is that it allows a researcher to find out to elicit information on why an issue is relevant, and what makes it so.

3.8.2 Methods of Data Collection at Stage two of research process

Qualitative and qualitative data using semi structured interviews and questionnaires will aid data collection at stage two of the research process. Documents accessible and available to the researcher were also used.

3.8.2.1 Semi structured interviews

According to Thomas (2011), semi-structured interviews adopts questioning based on a list of themes and the researcher where necessary has flexibility to follow-up on points raised by the interviewee. It also enables the use of a theoretically informed interview proforma to build structure into the data collection process (Fellows & Liu, 2015). In this research context, the semi-structured interviews allowed in-depth exploration of the themes that evolved from the literature on the characteristics of the CMS and efficacy on project cost performance in LcH project delivery. It also allows the gathering of implications for CMS improvements based on a variety of views of the case participants, to aid theoretical generalisation and a well-developed CMSM.

In February 2015, the researcher embarked on the qualitative phase of the fieldwork. To reach theoretical saturation, the researcher anticipated 30 semi-structured interviews with the PMT members. However, because of the challenges of participants' availability, only 23 interviews was conducted. This number was considered appropriate following views by (Mason, 2010; Baker et al., 2012) on the number of relevant interviews associated with case studies. The 23 interviews all took place in the state capitals of Enugu, Imo, Anambra and Abia States, where many of the PMT organisations have their branch or head offices. On a few occasions, the interviews were held outside the Nigerian southeast zone where the organisations had resident offices outside the zone. The participants presented with consent and agreement forms and assured on anonymity as well as their freedom to decline to answer any question or withdraw at any stage of the interview. The ethical approval detail is as attached in the appendix. There were difficulties during the conduct of the interviews, such as frequent interruptions by interviewee colleagues or failure to meet at appointment times. In spite of the challenges encountered, the researcher was able to manage the situation by rescheduling meetings over the weekends as conveniently agreed with the interviewees, which lasted for an average of 43 minutes.

- *Interview Guide*

The interview guide contained four sections: background information; LcH project delivery features, CMS characteristics, and constraints and implications for improvement covering techniques, process, and IMSF drivers. Before the guide was administered, three revisions were made following a pilot study amongst quantity surveying and construction management experts. This piloting process helped to rule out any ambiguity of the questions. The questions in the guide were pre-set themes evolving from findings from the literature and experiential knowledge. However, the researcher maintained flexibility in presenting the questions to allow the interviewees elaborate on the pre-set themes as well as give room for emergent themes.

The findings of data generated from the semi-structured interviews effectively directed the specific variables to include as questions in the questionnaires to allow for further understanding of the concepts from a wider set of respondents across the zone.

3.8.2.2 Questionnaires

The questionnaire allows further investigation on the findings from a qualitative phase. The questionnaires were constructed to gain the breadth of understanding of the variable in each theme by a wider sample of respondents. The findings from the semi-structured interviews were structured into multiple questions. The questions were designed to capture the views of the respondents (PMT members involved in LcH projects in the zone) for the purpose of identifying the specific components needed to develop the CMSM.

The researcher travelled to the study area to administer the questionnaire by self and through recruited field agents' (gatekeepers). The field agents were briefed on the purpose of the research and conduct of administering the questionnaires to the target respondents in the zone. Given the importance to maximise the response rates in a questionnaire survey (Saunders et al., 2012) the researcher adopted various means to enhance the response rate from the beginning of the questionnaire design to administration and collection. The researcher allowed sufficient time (2 months) for the collection of the questionnaires to ensure that a large possible return of completed questionnaires is achieved for meaningful data analysis. Email reminders, telephone calls (those that provided their email and telephone numbers) and revisits to offices were all follow-up measures to enhance the response rate. The researcher also ensured that the questionnaire was well-structured following recommendations from a pilot test.

- *Questionnaire structure*

The questionnaire was divided into two main parts (Appendix VII). Part A were background questions about respondents while part B contained questions on the LcH project cost performance, CMS, and IMSF drivers. The 4- point Likert scale was used to structure the questions in the questionnaire to gather the respondents' views on ratings in terms of the level of agreement, influence, frequency of use, and importance. The four- point Likert scale is used because it has no neutral option and allows useful choices to be selected from the listed answers (Tourangeau, et al., 2000). This scale was a good fit since the target respondents were presumed knowledgeable on the cost management practice in LcH project delivery in the zone. A pilot test on the questionnaire was carried out among ten construction experts from Academia and industry. Four academic experts from the School of Built Environment, the University of Salford, three from Architecture and quantity surveying, Imo State University and three from PMT members involved in LcH project delivery in the Nigerian southeast zone. These target respondents were practicing project managers, quantity surveyors, architects, and engineers. The pilot test was useful to eliminate ambiguity and refine the questionnaire where appropriate.

3.8.2.3 Documents

According to Yin (2009), documents are a source of evidence, which helps the researcher to review and evaluate both printed and electronic material that could be publicly available and less difficult to obtain. Documents are also important to help the researcher gain an insight into the historical evolution of the issue being investigated and provide information that serves as a guide to conduct interviews and administer questionnaires. The study reviews both the Nigerian NHP and project documents.

3.8.3 Method for Data Collection for Validation Purposes

The CMSM is expected to serve as a tool to improve the cost management outcomes on LcH projects. Further explanation on the CMSM design and development is as presented in Chapter 6. The study employs focus group and semi-structured interview to collect data in the third phase of the research. The focus group interviews were selected for the purpose of the gathering information to model the relationship between the components of the CMSM, using the ISM and IRP techniques. The IRP and ISM procedures are underpinned on the perceptions of experts whose opinions are necessary to define the salient points on the development and validation of the CMSM. The ISM is a well-established modelling technique that relies on an interpretive methodology based on the judgment of experts. It uses expert judgment to decide how the different factors relate and impose order and direction on the complexity of the relationships in a system (Sharma et al., 2014; Sage, 1977, cited in Attri, et al., 2013). The IRP is a novel ranking modelling technique that combines the strength of the intuitive and rational choice processes for decision making. It combines the analytical logic of the rational choice processes with the strengths of the intuitive process at an elemental level (Sushil, 2009). Chapter 6 extensively explains these techniques.

For validation, of the CMSM validation both focus groups and semi-structured interviews were employed. Bernard and Ryan (2010) argued that validation is the collective judgment of the scientific community about the validity of a particular concept and its measures. Therefore, validation" in this model context aims to enhance understanding and explanation. The validation exercise was conducted between January and March 2016. The focus group interview was used at the initial validation phase to ascertain the appropriateness of the model context, content, and completeness, its clarity, simplicity, and applicability in real life context. Ten experts were involved in the focus group; two each from the HAST, CST, and CNT who had been involved in the first phase of data collection and two academic experts in project cost management. The CMSM was refined following recommendations of the initial validation process. The final validation phase employs semi-structured interviews. The aim of the semi-structured validation interviews was to ascertain the appropriateness of the model and its applicability by the HAST, CNT, and CST in real life context. Six participants of the PMT were interviewed in the final validation phase. Further details of the participants are presented in Section 6.5.1.

3.8.4 Sampling Procedure

Before data could be collected in research, effective sampling procedures needed to be adopted. Sampling procedure involves determining the location, population, sample size, and the recruitment procedures for participants and respondents (Saunders, et al., 2012; Creswell, 2015). Denscombe (2010) also stated that before adopting a sample for a study, it is important to determine the following:

- Sample population refers to the items in the category of things that are being studied rather than the total people in a country
- Sample frame: contains the information about the sample population which can take the form of list of names addresses or contacts of those represented in the sample population from which the sample size will be collected

- Sample size refers to the items within the category of the sample population that have been selected to be involved in the study.

Saunders et al. (2012) pointed out that sampling is needed because it is impractical to survey or interview an entire population. Therefore, to maximize efficiency and validity sampling procedures are applicable both quantitative and qualitative investigations.

Probability and non-probability approaches are the two main sampling approaches. Probability sampling is employed to draw a representative sample from the population so that the results of a study can be generalised from that sample to the population. However, this may not fulfil the informational needs of the study and is clearly described suitable for quantitative investigations. In the probability sampling procedure, the target samples are selected through a process that gives equal chances of selection to all the individuals in the sample population. The techniques include the random, systematic, cluster and multi-stage and the stratified sampling techniques (Denscombe, 2010). On the otherhand, non- probability sampling aim is to provide illumination and understanding of complex issues which implies that the sample selected. Examples are quota, purposive, snowball, purposeful, convenience and theoretical sampling techniques (Denscombe, 2010: Saunders et al., 2009). This approach is not for the purposes of statistical representation or operate on the principle of random selection to obtain target samples but rather by pure chance. It is applied where smaller sample population is required and mostly associated with qualitative studies.

However, research may combine the use of both sampling approaches. According to Onwuegbuzie and Collins (2007) both probability and non-probability sampling approaches are required to drawn inference for purposes of completeness or confirmation in mixed method research designs. Though Yin (2009) and Thomas (2011) maintains that probability-sampling logic is not much emphasised in case studies because it covers both the phenomenon of interest and its context, yielding a large number of relevant variables that will require too many cases to allow for any statistical consideration. Therefore, in this study, for the purposes of collecting both qualitative and quantitative data from the case participants a purposive sampling technique is adopted.

3.8.4.1 Within case sampling of participants

The research adopted a non-probability sampling techniques following a strategic process to ensure that the participants selected for the semi-structured interviews were able to provide in-depth information on the CMS employed on the LcH projects in the Nigeria southeast zone. First, there was need to select LcH based on certain criteria:

- Variance in project sponsors,
- location of the project within the Nigerian southeast zone,
- accessibility to the PMT members,
- projects all experienced poor cost performances,

Four key LcH projects (two each from federal and state level within the zone) that met these criteria were selected. As stated by Amaratunga and Baldry (2001), this sampling technique projects theoretical sampling, which they described as most suitable for case studies as it aids theory development and generalisation to theoretical propositions. These project are anonymised with PA, PB, PC and PD and an overview the projects' information is as detailed in Table 3.7.

Table 3. 7: Selected projects information

Characteristics	**PA**	**PB**	**PC**	**PD**
Project type	**State-Led LcH project**		**Federal led LcH project**	
No of Housing Unit	67	75 units	120 units	50 units
Average Square Area	85m2	92 m2	82m2	85 m2
Procurement type	Design-bid- build	Design-bid- build	Design build	Design build
Project Cost per 2 bed unit	4.575 million	4.16million	5.5 million	5.5million
Final Total Cost	6.398 million	5. 1 million	7.99million	8.62million
Project cost Performance	40 percent cost overrun	23 percent cost overrun	45 percent cost overrun	57 percent cost overrun
Commission	2011	2014	2014	2013
Status	Completed in 2014	Sectional completion	Sectional completion	Sectional completion

Source: Researchers Field Survey (2015)

The interviewees were selected based on their participation and organisations involvement in four selected LcH projects. The participants purposively selected were PMT members representing the consultants, housing agency, and contractor site teams. The target participants were all construction professionals: quantity surveyors, architects, engineers, and builders. Their roles cut across project managers, project supervisors, project consultants, site managers, and supervisors. It is presumed that these participants based on their educational and professional roles well as members of the PMT on the selected LcH projects are well informed and will be able to produce the valuable data needed for the study.

In stage two of the research process, 40 participants were approached, 28 agreed to participate, but only 23 were available for the interview. A breakdown of the sampling frame of participants is presented in Table 3.8. Each participant selected were approached with due ethical process and approval. The interviewees and their organisation were anonymised using representative descriptors HAST, CST and CNT.

Table 3. 8: Sampling frame for semi-structured interview Participants

Project organisation	**Project management team**	**Interview participants**		**Total Participants**
		State-led LcH projects	**Federal-led LcH projects**	
Housing Agency	In-house supervisory team(HAST)	4	3	7
Consultancy organisation	Project consultant team (CST)	4	4	8
Contracting Organisation	Project contractor management team (CNT)	4	4	8
Total		**12**	**11**	**23**

HAST connote staff representing housing agency supervision team, CST staff representing the project consultants team and CNT staff representing project contractor team.

The semi-structured interviews were conducted face to face with the participants. The reason for choosing the face to face interview is that it gives the researcher the opportunity to directly meet with the participants and affirm the relevance of the person to be interviewed in relation to the topic studied. All the interview participants were briefed on the purpose, objectives of the research.

3.8.4.2 Within case Sampling of respondents

For the purposes of collecting quantitative data via questionnaires, the researcher also employed purposive sampling to select respondents. First, the researcher tried to identify the project organisations who had and are involved in LcH project delivery in the zone. Owing to the lack of a published list of these organisations, the researcher contacted the housing agencies within the various states in the zone and searched for a list of ongoing and recently completed LcH projects. Furthermore, the researcher also employed experiential knowledge and publicly available information to ensure that ongoing and recently past completed LcH projects within the past 10 years situated in the southeast zone of Nigeria were captured and crosschecked with the list compiled. From a complied list of the projects, eighty-three (83) organisations were identified. Given the manageable number of the project organisations, the researcher sent three questionnaires each to all the identified organisations totally 249 distributed questionnaires. Table 3.9 shows the distribution of the questionnaires amongst the identified organisations. The target respondents were project staff who were quantity surveyors, architects, engineers and builders. These experts were presumed knowledgeable on the topic area and could produce the most valuable data needed for the study.

Table 3. 9: Questionnaires Administration

Number of project organisations	No of questionnaires distributed	No of questionnaires Returned	Response rate
10 Nr Housing Agencies	30	26	86.67%
31 Nr Consultancy organisations	93	57	61.29%
(42 Nr) Contracting organisations	126	61	48.41%
Total	249	144	57.83%

Source: Field study, (2015)

A response rate of 57.83 percent was obtained. This rate was considered acceptable following results of similar investigations in the context (Ihua, et al., 2014) and the low response rates commonly associated with questionnaire surveys. According to Fellows and Liu (2015), postal questionnaires can expect a 25 to 35 percent response rate, while Sekaran (2006) is of the view that a 30 percent response rate is acceptable. However, in this case, the response rate was far above 30 percent.

3.8.5 Ethical Issues

As is the custom with every research project, ethical considerations are very critical to the success of such projects. Before the commencement of this study, particularly the data collection phase, the researcher sought and obtained permission from the University of Salford Research Ethics Committee to carry out this research under the tenets of the United Kingdom Research Integrity Office (UKRIO) guidelines. As such, this study adhered strictly to the tenets of these guidelines, especially as it concerned anonymity and confidentiality. Therefore, sensitive areas, involving inviting and gaining organisational participants and respondent informed consent agreement, data protection, and anonymity, were carefully considered and care was taken to follow the ethical approval procedure (Appendix II).

3.9 METHOD OF DATA ANALYSIS

Data collected can be analysed using different procedures depending on whether the data is qualitative or quantitative.

3.9.1 Qualitative Method of Data analysis

The qualitative data analysis procedures allow for words, text and images to be transcribed and coded for analysis so that findings emerge that provide answers to the research questions. Some of the methods for analysing qualitative data include content analysis, thematic analysis, discourse and narrative analysis, and grounder theory as shown in Table 3.10.

Table 3. 10: Qualitative Method of analysis

S/n	Qualitative Method of analysis	Description
1	Content analysis	Content analysis is a descriptive approach systematically coding and categorizing approach used for exploring large amounts of textual information unobtrusively to determine trends and patterns of words used, their frequency, their relationships, and the structures
2	Thematic analysis	Involves a highly inductive analytical approach whereby themes important about the data in relation to the research question represented in some level of pattern, response or meaning within the data set emerge from the data collected.
3	Comparative analysis	closely connected to the thematic analysis however in these case data from different people are contrasted until no further or new issue arise
4	Discourse analysis	Based on speech- how people talk what has made them talk. Speech is analysed as performance rather than the state of the mind.
5	Grounded theory	Analytical procedures involve the coding and categorization of data collected with the aim of deriving concepts and theories from meanings within a data

Source: Compiled by researcher from Krippendorff, (2004), Mills et al., (2010), Dawson (2009) and Saunders, et al. (2012).

Whereas they all have their strength and weaknesses, the content analysis has been identified as one of the commonly used methods of analysis because of its main advantage as a technique to make replicable and valid inferences from text to context of use (Krippendorff, 2004). It is argued that thematic analysis is a type of content analysis. According to Krippendorff (2004), a renounced author in the area of content analysis, content analysis can range from the simplest form of word count to thematic or conceptual analysis. This statement implies that thematic analysis is an aspect of content analysis. It is not a surprise that although it is widely employed in content analysis, thematic analysis has not been well described. The thematic analysis is the aspect of content analysis that uses a systematic approach to the analysis of qualitative data involving identifying themes; coding and classifying data. It is usually textual, according to themes, and interpreting the resulting thematic structures by seeking commonalties, relationships, overarching patterns, theoretical constructs, or explanatory principles.

3.9.1.1 Thematic-Content analysis

To explore the CMS for LcH project delivery the, opinions of PMT is required. Thematic analysis is an aspect of content analysis that facilitates both conceptual and relational analysis of the data. It helps to establish the existence, and frequency of concepts, which evolves through words and phrases in the data and examining the relationships among the concepts. According to Elo and Kyngäs (2008), a sequential procedure for thematic-content analysis involves preparation, organisation, and reporting. This procedure is adopted for this study. A diagrammatic illustration of the qualitative data analysis procedure is presented in Figure 3.4.

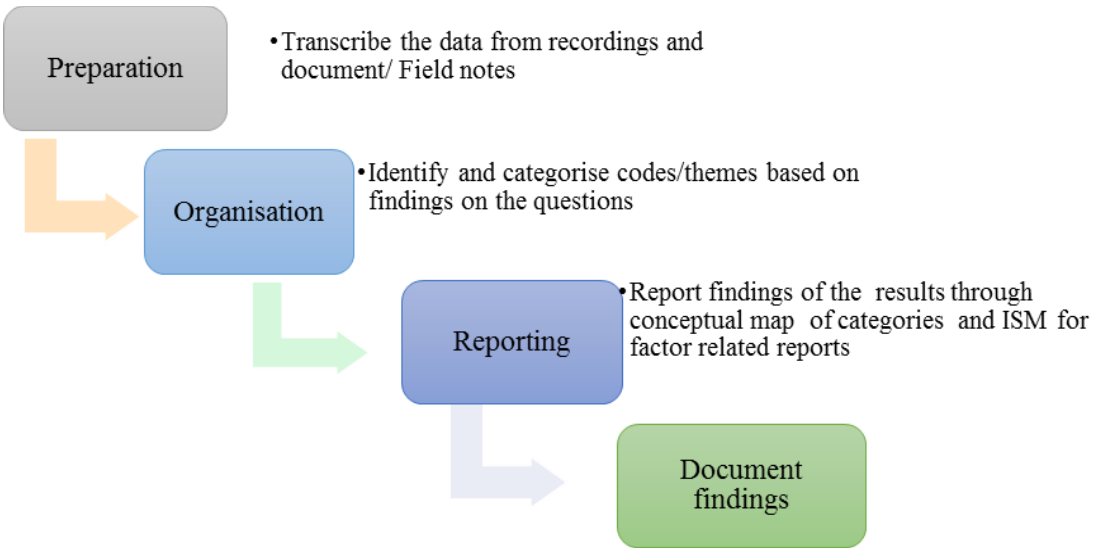


Figure 3. 4: Qualitative Content Analysis Procedure

Source: Compiled from Elo and Kyngäs, (2008)

- *Step1 one: Preparation*

This step involves transcribing the data and taking brief notes where relevant information was found. Familiarization with the data collected is necessary to gain detailed insight of the full information found in the data relating to the concept and context of the research. The researcher transcribed audio-recorded sessions and field notes from the semi-structured interviews conducted. The process of the transcription allowed the researcher to gain insight into the thoughts and reflections of the interviewees. Subsequently, through several readings of the transcripts, the researcher identified areas of relevant information in the data.

- *Step Two: Organisation*

This step is a major process in thematic-content analysis. It involves identifying common concepts assigning descriptive codes where appropriate and collecting the concepts under categories/themes, and comparing the emerged coding's clusters together and about the entire data set (Denscombe, 2010). The Identification of themes can be done deductively or inductively. Deductively is based on theoretical constructs that the researcher wishes to investigate the case. These include themes formed by research questions, interview questions, or theory-derived categories as a start list for coding data documents. This approach can facilitate within or cross-case comparisons (Mills et al., 2010). On the other hand, an inductive approach is more typical of thematic analysis. Themes emerge from the primary data through which researcher builds a complex exploratory, descriptive, or explanatory case analysis grounded in the particulars of the case or multiple cases (Mills et al., (2010). However, it has been suggested that the approaches could be combined in research for comprehensiveness.

Having gained areas of relevant information in the data, codes were assigned based on latent contents (structural meaning underlying the data) (Vaismoradi, et al., 2013). The codes were organised and grouped into sub-themes under an initial set of pre-set themes: from the research questions and literature and emergent themes from the data. Hence, both the inductive and deductive approaches were employed in the study. The main themes were cost performance, CMS- techniques, process, barriers and IMSFs carefully identifying possible links.

- *Step Three: Reporting*

This step involves reporting the data analysed which can be in the form of models, conceptual map or categories or a story line. This research reports the data analysed in a story line and with a conceptual tree-structure of variables. The tree structure was developed using the NVIVO a computer-assisted qualitative data analysis software specifically designed for thematic analysis of qualitative data with theory-building capabilities. The features of computer-assisted database management including coding, linking, searching, and model building, facilitate rigorous and sophisticated thematic-content analyses. A snapshot of the analysis report using the NVIVO software is shown in Figure 3.5.

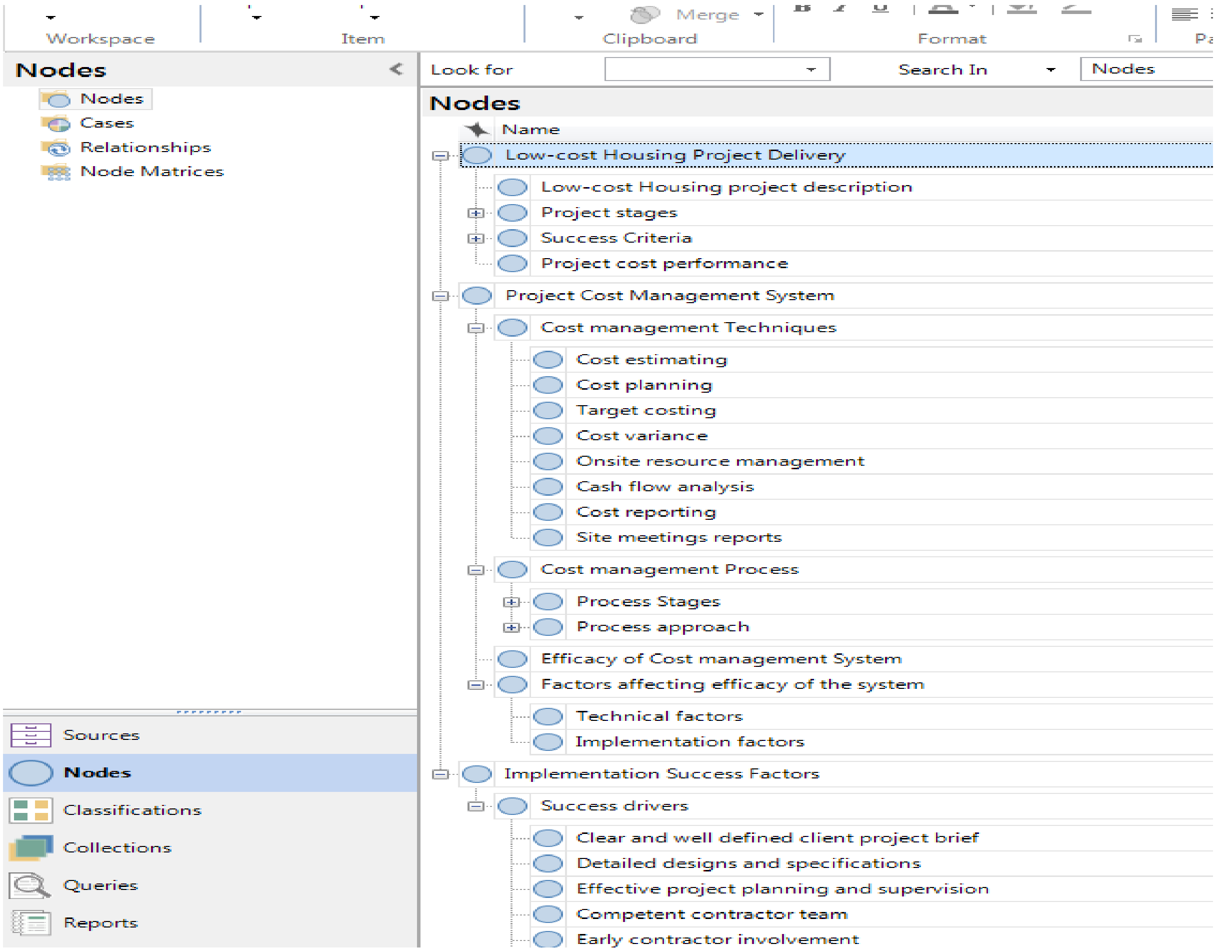


Figure 3. 5: NVIVO snapshot

3.9.2 Quantitative Data Analysis

Quantitative data is analysed using descriptive and inferential statistics. Descriptive statistics helps to define what is or what the data showed directly and used to describe nominal or categorical variables. However, it can also apply to ordinal variables, such as level of agreement in Likert scale responses. (Field, 2013; Pallant, 2013). Descriptive statistical tools include frequency counts and proportions, measures of central tendency and variation (Fink, 2006) which helps in analysing across cases one variable at a time and presented, using tables or graph.

On the other hand, inferential statistics seeks to explore group comparisons looking for patterns and relationships in the data with the purpose of drawing conclusions (Dawson, 2009: Field, 2013; Pallant, 2013). It is used to examine relationship or group memberships. To test differences, chi -square test- compare observed frequencies to expected frequencies, T-test compare means of two groups and one-way ANOVA test compare more than two groups (Pallant, 2013). Multiple regression or correlation analysis examines the strength of relationships between variables while exploratory factor analysis or logical group regression is most appropriate for group memberships (Field, 2013: Pallant, 2013). However, the choice of the methods will depend on the nature of the data and what need exploring in the data set (test differences examine relation, group membership or a combination). Owing to the anticipated volume of data, the Statistical Package for the Social Sciences (SPSS 20) software package would be used to facilitate better and clearer analysis.

The questionnaire is structured in both ordinal and categorical scales question format. The questions relating to respondent's background are expected to produce categorical data while those relating to respondents ratings will produce ordinal data. Part A comprised mainly of categorical scale while part B comprised more of ordinal scales. Therefore, both descriptive and inferential statistics are applicable. The data from the questionnaire will be analysed using the following statistical methods.

3.9.2.1 Frequency counts and proportions

Frequency counts and proportions relate to number counts and percentages. This study adopts percentage proportions to analyse the quantitative data and presents them using tables and bar charts. This analytical tool was considered most appropriate since mean and standard deviation are invalid parameters for descriptive statistics whenever data are on ordinal scales (Gamage, 2011), and it would aid easy understanding of the data results.

3.9.2.2 Relative Agreement Index (RII)

To generate an index of the perceived agreement of responses the Relative agreement index (RII) is used. According to Holt (2014), the RII may be described to reflect contextual application though the generic recognised term is relative importance index and its acronym RII. The RII is used to calculate the strength of index familiarity frequencies and ratings of responses on the frequency of use, the level of influence and level of importance. The RII is calculated using the equation 7.

$$\text{RII} = \frac{\sum W}{A * N} \quad \text{…… Eqn 7}$$

Where: W– is the weight given to each item by the respondents and ranges from 1 to 4 on the Likert scale,

A – is the highest rating (i.e. 4 in this case) and;

N – is the total number of respondents.

3.9.2.3 Kruskal-Wallis Test

The Kruskal-Wallis test is a non-parametric test of analysis of variance (ANOVA) by rank appropriate for the data collected on an ordinal or interval scale that is non-parametric (Pallant, 2013; Cooper & Schindler, 1998). A test compares differences amongst responding groups on an item or group of items in a questionnaire. It is used when the data is not normally distributed (Dawson, 2009; Field, 2013; Pallant, 2013). The Kruskal-Wallis test measures chi-square in its analysis and the degrees of freedom (df) for the chi-square statistic are equal to the number of groups responding to the questionnaire minus one (df-1). Hence, when the value of the asymptotic significance is greater than 0.05, it clearly indicates that there is no difference between the responses from the group respondents by rank (Pallant, 2013). In this research, the Kruskal-Wallis H test was used to establish if the responding groups (HAST, CST, and CNT) have differences in their views concerning a rating question, or variable in the questionnaire.

3.9.2.4 Exploratory factor analysis

Factor analysis FA is a statistical set of techniques applied to reduce a larger set of variables/drivers into a smaller set 'principal components', of" Factors" which account for most of the variance in the original factors (Pallant, 2013). Hence, variables that are correlated and largely independent of other subsets of variables are combined into factors. Various scholars, such as Xu (2013), have employed the FA in their studies to group IMSFs. In this context, the factor analysis (FA) is used to further analyse the results from the RII on implementation drivers. It offers not only the possibility of gaining a clear view of the data but also using the output in subsequent analyses (Pallant, 2013). The study adopts the FA analysis procedure posed by Chan et al., (2004) which involves:

- Identify the drivers
- Compute the correlation matrix for all the drivers;
- Extract and rotate driver into factors.
- Interpret and label the factors

A summary of the quantitative data analysis techniques used in this study is summarised in Table 3.11.

Table 3. 11: Data analyses methods employed in Relation to Questionnaire Sections

Questions	Categorical Data	Ordinal data		
	Frequency/ percentage distribution	**RII**	**Kruskal Wallis**	**Exploratory Factor analysis**
Part A				
Demography Level of agreement	√			
Part B section 1				
Level of agreement	√			
Level of Influence	√	√	√	
Part B section 2				
Level of agreement	√			
Frequency of use/ Level of Involvement	√	√	√	
Part B section 3				
Level of agreement	√			
Level of criticality		√	√	√

3.10 CREDIBILITY OF RESEARCH FINDINGS

The process through which a researcher checks the quality of data, results and four tests have been widely used to establish the quality of empirical social research; namely construct validity, internal validity, external validity, and reliability. There are vital requirements that must be considered for a research to be valid. Yin (2009) and Denscombe (2010) identified these basic requirements as validity (internal and external) and reliability validity.

3.10.1 Reliability of Research Findings

As the name indicates, this test aims to assess the reliability of the research design. Yin (2009) expressed that the objective of this test is to ensure that if a later researcher decided to follow. The same procedures used in this investigation and follow the same case study design would arrive at the same conclusions. Reliability refers to consistency. Pallant (2013) noted that internal consistency is a way of assessing reliability. Cronbach's Alpha (α) is the most widely used and elaborated measure currently for internal reliability. It helps determine the extent to which the items in the questionnaire or items in a question are related to each other; an overall index of the repeatability or internal consistency of the scale as a whole; and identify problem items that should be excluded from the scale. Therefore, Cronbach's Alpha was considered for checking the internal reliability of the questions by conducting a reliability analysis using SPSS version 20. It is expected that the research design will meet reliability test.

In using Cronbach's Alpha to measure the reliability of the construct of the factors itemised in the questionnaires, it is noted that the higher the value, the more consistent items are with each other. The generally acceptable coefficient value indicators for reliability are documented by Pallant (2013) as shown in Table 3.12. A low coefficient indicates that the sample items have not been able to capture the construct, while a large alpha indicates that the given item correlates well with the true scores.

Table 3. 12: Cronbach Alpha Table

Interpretation	Value
Excellent	$\alpha \geq 0.9$
Good	$0.9 > \alpha \geq 0.8$
Acceptable	$0.8 > \alpha \geq 0.7$
Questionable	$0.7 > \alpha \geq 0.6$
Poor	$0.6 > \alpha \geq 0.5$
Unacceptable	$0.5 > \alpha$

Source: Compiled from Pallant (2013)

3.10.2 Internal Validity of Research Findings

Internal validity refers to the extent to which the investigation instruments provide adequate coverage of the investigative questions. (Yin, 2009). According to Saunders et al. (2012), the validity is a requirement to ensure that the research findings conform to what the researcher sets out to achieve. It also shows the appropriate nature of the data collection techniques and the research design for answering the research questions. Therefore, it is strongly associated with data collection and analysis procedures.

Yin (2009), acknowledges two forms of validity; construct and internal validity. Construct validity is attained by the use of multiple sources of evidence, establishing a chain of evidence, use of key informants review draft of case study report and a convergent line of inquiry. Internal validity deals with pattern matching and explanation building. According to Patton (2003), it refers to the triangulation that can include methodological, data source, investigator, and site triangulation. The use of different sources of data from literature, documents, semi-structured interviews, questionnaires and focus group the researcher to collect variety of relevant information on the LcH project delivery and cost performances including the CMS. These methods allowed an in-depth insight into the LcH project delivery and cost performances including CMS employed by the PMT. The analysis of the data collected allowed the triangulation and explanation building for viability purposes. The findings also gathered aided the development of the CMSM and validate its applicability in improving LcH project cost management and performances. The several data collection techniques employed enabled methodological, data source and perspective triangulation, as shown in Table 3.13.

Table 3. 13: Triangulation as used in the research

Triangulation type	Explanation	In Study context
sources Triangulation	Consistency of data sources.	Checking and comparing findings of semi-structured interviews, questionnaire and extant literature
Methods triangulation	Consistency of findings from different data collection methods	Mixed methods involving literature review, questionnaire survey, and semi structured interviews
Perspective triangulation	Using multiple perspectives (perspectives of various stakeholder positions) or theories to interpret data	Comparing perspectives of the housing agency supervision team, consultants team and contractor team members.

Source: Adapted from Patton, (2003)

3.10.3 External Validity of Research Findings

According to Yin (2009), External validity is concerned with knowing if the findings from a study can be generalised beyond the immediate case study investigated. He also stated that case study designs use a theory or propositions as a basis for the generalisation. The theory or proposition is tested by the replication of the findings based on case investigations; as a result, external validity can be met. In this study, generalisation is analytical derived from the propositions used to develop the CMSM and not the sample population. Therefore the core results this research results on the CMS and CMSM are mainly generalizable for LcH project delivery in Nigeria and especially the southeast zone. However because it is an analytical generalisation the findings could apply to similar contexts. But in a case where the findings want to be generalised to other settings, further investigations may be required.

Critiques have expressed concern for generalising conclusions from a single case study. Some studies have maintained that single case studies are incapable of providing generalised conclusions (Tellis, 1997). However, outcomes from individual case studies are not statistically generalizable but analytically generalizable (Welsh & Lyons 2001). Hamel et al. (1993) and Yin (2009), further maintained that the "relative size of the sample used, whether small or large, does not transform a single or multiple cases into a macroscopic study. Hence, the single case could be considered acceptable, provided it meets established objectives for the study. However, Yin (2009), if a single case is properly conducted, it is expected to contribute immensely to knowledge than a poorly designed multiple case study designs. This is because since sampling logic is not the situation in case studies.

3.11 CHAPTER SUMMARY

This chapter has presented the research methodology adopted to address the aim and objectives. It justifies the choice of an interpretivist philosophical position, a single embedded case study strategy, and a sequential exploratory mixed method of data collection and analysis. It discusses the procedure to undertake the research process explaining how each stage is implemented. Details on how information on the research concepts will be gathered from members of the PMT involved in LcH project delivery in the Nigerian southeast zone was also given considerable attention. The next chapter documents the analysis and result of the qualitative phase in stage two of the research process.

CHAPTER FOUR
QUALITATIVE DATA ANALYSIS AND RESULTS

4.1 INTRODUCTION

Chapter 3 discussed the justification for the selected methodology for the research. This chapter proceeds to present the narratives of qualitative data analysis and results of the case study. Furthermore, the following propositions will be tested using the findings from the semi-structured interviews:

- Ineffective CMS influences poor LcH project cost performances
- The choice of techniques and process approach influences the efficacy of the CMS to achieve expected performance outcomes.
- The current CMS need both technical and implementation improvement for effective outcomes.
- Certain IMSF are pivotal to maintain effective and viable CMS implementation.

This chapter is structured as follows:

- Empirical Demography of Interviewees
- Concept of LcH project delivery
- Characteristics of LcH project cost management system
- Implementation drivers
- Improvement measures
- Summary of Qualitative findings from case study

4.2 CHARACTERISTICS OF INTERVIEWEES

The purpose of this theme in the interview is to establish the demographical information of the participants investigated. This information is needed to improve the credibility of the research findings by establishing that the data source was appropriate, relevant and knowledgeable in the topic being investigated. The interviewees were selected based on their participation and organisations involvement in four the selected LcH projects, (Section 3.8.4). The participants selected represented the views of the HAST, CNT, and CST in cost management practice in LcH project delivery. The researcher conducted face-to-face semi-structured interviews and ensured that the target participants were involved in the managerial decision and implementation of cost management practice on the projects. The researcher considered this purposive selection appropriate as these participants will have the required knowledge and information needful for the study to achieve the set aim and objectives.

Seven HAST members were interviewed. This team is responsible for the general supervision of the project and serve as a monitoring team to the consultant and contractors on behalf of the client reporting to the project manager, who is the head of the team. The participants in this team all had professional qualification in architecture, quantity surveying, engineering, and building at the graduate and postgraduate levels. The HAST interviewees had a minimum of ten years and a maximum of 17 years of experience in LcH project delivery. Eight CST members were interviewed. This team is responsible for expert services on the LcH projects ranging from architectural services to quantity surveying, structural, mechanical and electrical engineering services. The interviewees constituted two PhD holders, four MSc holders, and two BSc holders. The CST, the interviewees, had a minimum of seven years' experience and a maximum of 15 years of experience in LcH project delivery. Similarly, eight CNT members were interviewed. This team is responsible for the actual construction of the LcH and have direct responsibility to supervise the subcontractors on the project. The interviewees were all qualified construction professionals in the field of architecture, engineering, quantity surveying, and building and have their roles as the contractor's site supervisor, manager or quantity surveyor. Four of the CNT interviewees hold an MSc degree and the other four BSc degrees. The interviewees had a minimum of five years' experience and a maximum of 11 years of experience in LcH project delivery. A summary of the interviewee profiles from the selected projects are presented in Table 4.1.

Table 4. 1: Background of Interview Participants

Project management team	Organisation	Number of interviewees	Role	Professional Background	Qualification	LcH project delivery Experience
Housing Agency supervisory team (HAST)	Housing Agency	1	Project manager	Architect	MSc	10 years
		1	Project manager	Architect	MSc	15 years
		1	Project manager	Quantity surveyor	MSc	17 years
		1	Supervising Quantity surveyor	Quantity surveyor	BSc	13 years
		1	Supervising Engineer	Supervising Engineer	MSc	10 years
		1	Supervising Engineer	Engineer	B.SC	11 years
		1	Supervising Architect	Builder	BSc	10 years
Consultants team (CST)	Consultancy organisations	3	consultant Architects	Architect	MSc	10 years 15 years 12 years
		2	Consultant Qs	Quantity surveyor	BSc	10 years 7 years
		1	Consultant Qs	Quantity surveyor	MSc	9 years
		2	Consultant Engr.	Engineer	PhD	16 years 11 years
Contractors site team (CNT)	Contractors organisation	2	Site Supervisor	Engineer	MSc	5 years 11 years
		2	Site managers	Architect	MSc	5 years 7years
		2	Site QS	Quantity surveyor	BSc	10 years 8 years
		2	Site supervisor	Builder	BSc	5 years 9 years

Source: Researcher's Field work (2015)

The analysis of background information of the participants indicates that there is a balanced distribution within the sample interviewed representing the HAST, CST, and CNT. Findings also reveal that all the participants and respondents had a minimum of a graduate-level university degree and an average of 10 years' experience in LcH project delivery. The interviewees based on their role, professional and educational background are knowledgeable in project cost management and especially for LcH project delivery in the zone. Therefore, their knowledge and experiences can be considered useful within the context of the research. Based this analysis and findings it is justified that the interviewees have significant relevant knowledge in LcH project delivery in the zone, and their opinions are needful for further investigation in this study context. The next section presents the findings of features of the LcH project delivery in the Nigerian southeast zone.

4.3 CONCEPT OF LOW-COST HOUSING PROJECT DELIVERY

Regarding this question, all the participants maintained consensus on the peculiarities of LcH project delivery. They acknowledged that LcH is mainly government-led (promoted and financed) and targeted at those within the low and Lower-Medium incomes through the mortgage or outright purchase. The main objective of such project is towards achieving affordability to the end users based on their income. According to:

> ***HAST*:** "LcH is different from other types of housing because affordability is the main project objective. These houses do not exceed three bedrooms semi-detached bungalows with only basic facilities and are clustered together unlike the high income houses. The aim is to provide cheap quality housing for people who are below the middle-high income bracket so that they can afford them on a mortgage repayment plan calculated at 1/3rd of earnings over 20-25 years or outright purchase."

> ***CST*: "**LcH have a minimum size of 10m2 area by room and usually between 1-3 bedrooms bungalow for low and middle incomes… the FMBN through the national housing fund provides prospective applicants' access to up to 15million depending on calculations on the mortgage so that they can afford the houses. The government is the promoter provides land and basic infrastructure as an equity contribution".

> ***CNT:*** "LcH is mostly bungalows within defined standard terms of size and quality of what their salary can afford. It consist of a parlour, and not more than three bedrooms, a toilet, bath, and kitchen. The main issue is to make this housing cheap for them, so everything is not high standard specification but they can improve aesthetics as their income increases".

The participants went further to describe LcH project delivery. All the interviewees affirmed that the LcH projects are prototype mass housing comprising of a minimum of fifty units per location. Their statements confirm this definition.

CST: "LcH projects are massive prototype housing construction running concurrently in different areas of the state at a time. They have regulated sizes, design, and specifications to fit. Like other residential building project need to be completed within specific time and cost".

HAST**:** "LcH projects are prototype construction mass housing. Just as you can see, they are more than fifty dwelling units in a project. The houses have a basic design, the size of stipulated standards, which need to meet the budget cost as much as possible".

CNT: "…well I will describe the project as prototype 1-3 bedroom residential building construction, containing up to 100 units to be completed within target cost… and have a start and finish duration".

The participants went ahead to identify the delivery process of LcH projects. They claimed that LcH projects like other building projects involving four main stages. The following are their comments:

HAST: "LcH project delivery is the third phase of the housing provision process. The project brief is developed into a design and constructed through four main stages; the predesign, design, bidding, and construction. Consideration of the end users, the cost, and the location are all crucial factors to be considered at the pre-design stage. On the PA we employed the traditional contract system on our project, and the contractors were engaged at the construction stage. After completion of the houses, we take over, and we move to the next phase of the housing supply process, which is allocation".

CST: "Firstly, an initial brief, feasibility studies, and analysis are carried out by the in-house professionals or consultants engaged. The procurement type either design or build or traditional delivery method are commonly employed. On the PB, the traditional system was employed. So the consultant develops the design and produced the working drawing and prepare the bills of quantities. When approved by the housing agency, the contractor was engaged in the bidding process to carry out actual construction and handover".

CNT: "LcH project stages involve planning, design and documentations select the contractor through the tendering procedure and do site works, and it ends with the construction stage. In the design and build, however, the contractor is engaged later in the preliminary design or earlier main design stage, but that is not the case in this project".

HAST: "The LcH project delivery process in PD involved brief development then bids were thrown open to contractors. The major thing is getting the contractors to make an input on how much they can deliver the housing units and at what cost. Then details of the cost elements what is involved and how much it would be delivered to the end user is projected and submitted. At this point, the government agencies decide on commissioning the contractor. If approved, the final design and cost estimates are produced, and construction undertaking after practical completion such projects are handed over to the government agencies for sales or allocation as the case may be. The design and build system is adopted though yet to gain much grounds particularly in this part of the country".

These comments were in consensus with those of other HAST, CST and CNT participants from PC and PD. The researcher went further to ascertain the criteria for LcH project success. On this theme, the participants stated that:

CST: "Meeting target cost is critical because our focus to benchmark time and quality is cost. So when we stay longer on the job, we tend to spend more money because time is a factor with cost impact. Also constructing the houses as specified in the design shows we have done a good job".

CST: "I tell you, success is achieved mainly when cost, quality, and time performance are delivered within specified targets. These are the basic things in the conceptualisation of effectiveness. However, given stringent government budgets, cost performances is always a priority".

HAST: "…we consider cost primarily, then time and lastly quality. This is because the last variable can be improved upon unlike the first two if you know what I mean. So when we combine cost and time, and we can achieve this two, we have 80 percent success on the projects".

CNT: "…delivery within stipulated cost; that is what satisfies the client, project time because of how things increase in the market, which also affects the cost and quality. For example, because the basic standard quality is specified does not mean when the door is open it falls off because we want the house to be affordable. Therefore, we also need to deliver at the stipulated quality in line with the target cost to satisfy our client for future job relationships".

They further affirm the priority accredited to effective project cost performance as a success criterion. In their comments:

HAST: "Completing the project within set out budget is critical."

CST: "Cost performance is the most important factor for successful delivery."

CNT: "Delivery to stipulated cost is most important because the moment we start overshooting the project cost, sales price is affected, end-users may not be able to afford the houses, and our profit margin as contractors is also threatened".

These views were in consensus with all other participants interviewed from on PA, PB, PC and PD.

Having identified from the participants that effective project cost performance was a high priority on LcH projects in the zone, the researcher inquired further to understand why its prioritisation. In this regards, participants commented that:

HAST: "The objective of affordability as emphasised by the government largely depend on the final project delivery costs. Therefore, before going into the project, we mark the price for sales based on the target cost. Therefore, delivery within that cost target is very critical for us to actualise the proposed quantities to be constructed and also achieve a sale price that can be affordable to the target beneficiaries".

CST: "Talking about the project implementation -project cost constituting design and construction cost is always a priority. …project cost is significant sometimes accounting for up to 70 percent of the totality of the development cost … land cost accounts for only 10-12 percent because the government subsidizes them. Project cost carries a lot of weight so with overruns high the total development cost is inevitable and can affect sales prices”.

HAST: “Well, the project cost is a significant aspect of the total development cost. Land acquisition is reduced to less than 20 percent because the government acquires the land. So if project cost performance is poor, the cost of sales will increase, and in some cases, only fewer units than proposed can be delivered”.

CNT: “The project cost which includes professional fees and construction cost has the majority up to 80 percent of the totality of the development sum. Therefore, effort towards LcH development must be aimed at reducing project cost. In fact, based on our experience, it might shock many people to know that project cost is cheaper in Lagos and Abuja than in Owerri and generally in the southeast”.

These comments were in conformity with the views of the other participants interviewed from PA, PB, PC and PD.

4.3.1 Findings Low-cost Housing Project Delivery

Based on the comments of the participants from the HAST, CST, and CNT, it clearly indicates that the LcH project delivery consists of four main stages: predesign, design, tendering and documentation, and finally construction stages. The type of procurement system employed influences the sequence of the delivery stages. The participants expressed that both design bid build and design build procurement system are employed to deliver LcH projects in the Nigerian southeast zone. It was further deduced from their comments that the success of the LcH project delivery is defined by the effective performance of four main criteria: completion within stipulated budget and time, quality, and end-user satisfaction. They went further to highlight effective project cost performance as the most prioritised success criterion on these projects. This finding justifies this research focus on the need for improved project cost performances.

The next section details how the system employed to manage LcH project cost and its influences on cost performances.

4.4 LOW-COST HOUSING PROJECT COST MANAGEMENT SYSTEM

This theme seeks to understand the project management team manages project cost. The questions in this theme are structured as follows:

- Project cost management techniques
- Project cost management process approach
- Efficacy of the CMS employed on project cost performances

4.4.1 Cost Management Techniques

Findings from literature review identify common techniques employed by PMT to manage project costs. This section documents the results of contextual investigations on cost management techniques used in the CMS for LcH project delivery in the southeast zone. The participants involved on PA acknowledged that cost estimating technique was used to plan, estimate, prepare the bills of quantiles and budget the project cost at the design stage while, cash flow analysis, regular site meetings and cost reporting were used to monitor and control the project cost during the construction stage. Participants involved in PA had these views.

> ***HAST:*** "On PA we adopted the cost estimating method to plan estimate and arrive at the Bills of quantities for the project. The bills give the estimated elemental cost targets for the project from the designs. From the bill of quantities, the cost baseline was prepared. The cash flow analysis and regular site meetings and on-site performance reviews are techniques to control the cost".

> ***CNT:*** "Well usually in many building projects like this, cost estimating is used. I believe that what is mostly used in the project at the design stage. We were engaged just before construction so I cannot be certain other techniques used. But for cost control, we used the cash flow analysis, cost reports and on-site management of labour and materials. As contractors, we adopt this technique mainly for labour and material control to prevent spending unnecessary costs onsite".

This comment corroborates those espoused by the other four HAS T CST and the CNT participants involved in PA. Participants involved in PB also had similar comments though with little variance.

HAST: "Well we employed target costing, cost planning and cost estimating at the predesign stage and design stages for planning and preparing the Bills of quantities. For cost control during construction, we depended on performance reviews from site progress and meeting reports, but we also used cost reporting and cash flow analysis techniques on PB".

CST: "We employed TC to set and plan the estimated project cost. The TC together with the CE was used to develop the elemental costs and produce the bills of quantities. The BOQ breakdown the estimated project cost into the elements and from which the budget for the implementation stages for each month was established. For cost control, site progress meetings, cost reporting and of course cash flow analysis were used. Monthly site meetings were critical to seeing what is actual to what has been projected and if there are any costs implications the quantity surveyors review where necessary in their valuations".

These views were typical with those espoused by the four other participants from the HAST, CST, and CNT involved in PB.

According to the views of participants from PC:

HAST: "We employed cost estimating on PC to develop the estimated bill of quantities based on the preliminary designs. During the construction stage, the BOQ was monitored using site progress meeting reports to evaluate cost expended and work done".

CST: "We adopted elemental cost estimating which is a common technique in use by many quantity surveyors. This method is to determine the probable cost of construction and arrive at the estimated project cost for PC. We used the cost estimates and cost scheduling technique to programme the budget against time. At the construction stage, we employed performance reviews and cash flow analysis".

These views were in consensus with comments of the three other participants from CST and CNT involved in PC.

All the participants from HAST, CST, and CNT on PD acknowledged the use of techniques same as those used in PC. From their comments:

> ***CST:*** "As quantity surveyors, cost estimating is one main technique employed. We used both approximate and detailed estimating methods. The approximate at the design 1 stage while the detailed estimating method at the design two stage to produce the Bills of quantities. After that, cost estimating method was also used to prepare the budget baseline breaking the elemental costs into work packages for monitoring purposes. We adopted cost variance and cash flow method for cost control".

This view was in agreement with the five other participants from the HAST, CNT, and CST that were involved on the PD.

Based on the comments of the participants seven techniques were identified used in the CMS.

4.4.2 Cost Management Process Approach

Findings from literature review identify two main process approach. This section documents the results of investigations on the process approach adopted by the PMT in the CMS employed on the projects. The comments of participants revealed that the design- set- control approach was employed on PA, PC and PD.

> ***CST:*** "Basically, at the predesign stage the functional requirement for the project is stated. On this basis, we developed two to three different conceptual designs. Preliminary estimates were determined to have an idea of the probable project target cost. A choice of design is selected based on the lowest project target cost. Full working drawings are then designed, and bills of quantities prepared. Then the estimated project costs were more than 10 percent of the initial preliminary cost. We tried adjustments to the designs. To bring cost closer to the budget in mind, but the agency gave authorisation to proceed at 7 percent above the budget. The final Bill of quantities was produced, and on this estimate, the estimated project target cost was established. The BOQ became a guide to control cost during construction".

> ***HAST:*** "First conceptual designs were developed based on the project brief, usually handled by our team in the project department. The conceptual design was prepared and using square area method of cost estimating preliminary cost was determined. After final working drawings, bills of quantities were prepared. We observed that the costs were higher than the budget so we revisited conceptual designs and adjusted the final

> working drawings. The estimate in the BOQ becomes a guide to control cost during construction”.

These comments were in corroboration with statements by the participants representing the HAST, CST and CNT involved in PA, PC and PD.

Also, six of the participants representing the HAST, CST, and CNT acknowledged that the cost-design-control approach was employed in PB.

> ***CST: “***To establish the estimated project target cost, we designed on reverse consideration. The budget per unit was established by the housing agency based on findings of what the beneficiaries could afford. Then we planned and designed to that budget employing target costing method. The design is informed by the affordability of the people. The. Quantity surveyors prepared the cost estimates for each element and used it to produce the bills of quantities and cost target. During construction, we control using cash flow analysis mainly and site progress meetings… but you know, in our country what you plan is not always, what you get”.

This view was in consensus with the four other participants from the HAST and CST who were involved on the PB.

Based on the comments of the participants both design-cost-control and cost-design-control approaches were identified used in the CMS.

4.4.3 Efficacy of Current CMS on Project Cost Performances

Findings from literature review reveal that the efficacy of CMS influences the outcome on project cost performances. This section documents results on the level of the influence of the CMS employed on the LcH project cost performances.

All the participants interviewed acknowledged that the CMS employed was unable to deliver effective cost performance on the project.

> ***HAST:*** “.No, the system cannot be considered effective because we experienced cost overruns. There were problems from the planning to control”.

CNT: “The system was not very effective because there were a lot of variations in spite of the provision of an allowance for contingencies… The truth of the matter is that the method employed did not achieve our expected outcomes for cost performance. The designs were not cost effective, and during construction, we were not able to have effective on-progress cost review that can help us in our cost control”.

CST: "The truth is that the system has not been very effective you know what I mean. There are many cost overruns associated with the systems we use because of so much room for laxity and waste. We need to improve on this system in future projects. A poor system makes poor cost performances inevitable as you can see in the case of PA”.

HAST: “…how the project cost is managed is the main factor affecting performances. Of course, a poor system will affect the outcome on cost performances. That why we as a team need to come together and find a better way to manage costs because the extent of poor cost performances is now a norm on these projects”.

These views were corroborated in comments by all the other participants from the HAST and CST interviewed acknowledging that the system employed could not facilitate effective cost performances.

Based on this discovery, the researcher went further to understand the reasons why the systems employed were not effective. Their comments are presented in the next section.

4.4.3 Reasons for Ineffective Project Cost Management System Outcomes

Some of the challenges identified by the interviewees contributing to the poor effectiveness of the CMS were both technical and implementational. In their comments:

HAST: “Well, at the design we planned the cost, and I will say we minimised waste from design. At the design stage we minimise unnecessary cost by using target costing and cost planning and estimates that helped designing to a target cost effective considering what we did before on past projects, though may not be properly carried out by the team… but at construction, we had major challenges to monitor and control the costs particularly using cash flow and performance reviews from site meeting.

CST: "As part of the design team, we task ourselves to put a design with the budget examining the choice of building materials and finishes and estimating their impact on costs. Though we faced few challenges during design, it was minimal compared to what we faced to manage cost during construction. At construction, there were a lot of challenges controlling cost. The methods used for monitoring and forecasting cost performance and variance made it difficult to control cost affecting the cost savings earlier made and leading to cost overruns".

HAST: "the level of cost control was appalling, and we were not able to monitor the cost budget pet time and ended up using more than the set contingency allowances given the level of variations and design changes encountered during construction".

CST: "I believe from the preliminary designs; there was no proper cost planning, we depended on cost estimating and the estimates accommodated many provisional sums. The elemental cost estimates were not economical to achieve the target cost expected for LcH. So, the problem is how the cost was managed from the beginning".

CNT: "I think the way the cost was planned and controlled was not as effective. Though there was a budget, most times design is done before setting costs. The methods used do not allow evaluation of alternative design solutions to meet the target cost. More focus was on estimating the costs rather than proper cost planning. The poor design considerations also affected the cost. During construction as well, real-time cost monitoring is lacking. We depend only on the bill of quantities for our performance reviews. All these constraints affected our efficiency to control costs from early stage".

HAST: "It either we are using the techniques wrongly, our approach to management is inadequate. The implementation of our management strategies needs to be more effective".

***CNT:* "**Holistically, we have a problem of designing to cost, planning the cost and real-time monitoring of costs. For example our dependence on cost estimating and cash flow for cost planning and control is a problem. Though cash flow analysis is good… it helped to spread the budget across the housing units and duration of the project…but honestly, cash flow is only effective to document cash coming in or going out that's all and not totally for monitoring cost performance per se".

In addition to the inappropriate use of techniques, some barriers affecting CMS implementation were also highlighted in their comments. These barriers include : unclear client project brief, lack of commitment to project objective, construction waste, poor project planning, errors in design, bureaucratic process delaying funding and approvals, lack of coordination and collaboration amongst the consultants, lack of adequate cost data, incompetent project professionals, construction waste, economic instability, design changes, and variations along with community restiveness and burglary.

- *Unclear client project brief*

  CST: “We many times design based on preliminary designs originated from in the house professionals not with an estimate or call it a budget. …so the initial concept of LcH requirements is not always properly articulated by the housing/project manager, not until designs are completed, or construction begins. Many times, the PM complain about our designs been too large or expensive without giving us a clear brief on what is needed”.

- *Lack of commitment to project objective*

  HAST: “There is a lack of serious commitment to the objective of the scheme by the designers. They just want to be paid and move on. Many times they produce designs and specifications that are uneconomical at the end of the day which drive project costs higher than budget… so how can we deliver at affordable costs when there is the lack of consideration in arriving at economic design targets for the projects”.

This view was in consensus with the five other participants from the HAST, CST, and CNT.

- *Poor project planning and poor supervision*

  CST: “often times, because of the impact of the LcH project on their political portfolio and success in office time constraints on the project affect effective planning. This impact is more severe on the design stage were detailed planning is required. Because of the demand to deliver in short duration effectively planning is undermined leading to a lot of errors in design and the incomplete information for construction”.

  HAST: “Poor site supervision and management is a problem affecting cost control. Even when you have the right techniques, and there is no effort made to effectively manage the site give room for delays and construction waste that will end up affecting costs".

CNT: "The consultants that are supposed to give advice or clarification during construction are hard to reach and rarely around. They should be part of supervision".

This view was corroborated by six other participants, from CST and CNT.

- *Lack of PMT coordination and collaboration*

  HAST: espoused that "at the planning process, there was lack of coordination and collaboration amongst the consultants…. the lack collaboration amongst the consultants is a major problem. They do not work together as a team and put away their professional differences".

  CST: "The coordination level between the prime and other consultants was no good which results in delays because the activity of one consultant depends on the other consultant".

- *Lack of available cost data*

  CST: "the lack of adequate cost data bank makes it very challenging during elemental cost allocation. In some areas, we made some assumptions on cost which during construction led to variations that had negative cost implications".

- *Poor competency of the professionals*

  HAST: "Poorly experienced professionals, especially in the area of cost management, is a problem … Cost effective design is tough to achieve with professionals who have no such experience. Most clients are not aware of what entails cost-effectiveness, which is the duty of the consultants and particularly the Quantity Surveyor. However, when these professionals also don't know how to assist in places where in the design cost reduction could be achieved it double tragedy".

  CNT: "Even the QS themselves also do not know how to assist in places where in design cost reduction could be achieved because of lack of document cost data information. So everything relies on the architect and that is one thing we are not doing right here".

CST: "The problem can be traced from the laxity of the quantity surveyor to advise correctly during the design development. In my view, the overrun on the budget even started from the design".

- *Contractor's incompetency*

HAST: "… incompetency on the part of the contractor is a problem that results in poor quality of work and low work output, which leads to delay and demolitions affecting costs".

CST: "often times, the contractors engaged are incompetent. They have no experience in project delivery but are awarded the contract based on political grounds and favours… what can we do, they have no contribution to effective cost planning or control and we just have to work with what we are given. You cannot expect quality work anyway".

This comment was in consensus with four of the participants from the CST and HAST.

- *Construction waste*

CNT: "Construction waste results from design and estimate errors, poor material quality and poor site supervision. Mistakes in construction require demolition and all these affect cost control".

CST: "The unnecessary waste of time and materials resulting from poorly detailed drawings errors in quantity estimate and design changes were unimaginable. These errors from the consultants led to demolitions in some areas already constructed".

CNT: "The poor quality of materials that was used at the construction stage would not give the required quality of work and causes construction waste, which includes rework and or extra materials. The need to substitute will also increase cost".

- *Bureaucratic process affecting approvals and funds*

CNT: "Delays from Government bureaucratic process affecting approvals was one of the problems that affected cost control."

CNT: "The bureaucracy to release funds is terrible. How can we manage cost effectively when the funds do not come in as planned? By the time you go to buy materials, it has risen because the fund you expect to get in April did not get approved for release till December. Such delay will have a cost impact on the project".

- *Inclement weather condition*

CNT: "When we build during the dry season, the contractor is happy but during the rains rework is inevitable creating additional costs. For example, excavations collapse. Then the way prices go up and down with materials and labour".

This view was in agreement with comments by ten other participants from the HAST, CST, and CNT.

- *Design Changes*

HAST: "Design changes here and there affect the budget cost and sometimes lead to overruns. When we go to inspect, there is always the issue of one aspect of work demolished or not complete because of change in specification or wrong information".

CNT: "Poor site investigations lead to design changes during construction. Most of these projects have prototype design. On the site, you find out that cost of the substructure for building A is different from that of building B. Variations set in..."

CST: "The considerations of site conditions which were not carried earlier also lead to unforeseen extra works in foundations. These conditions were not taken into considerations before the budget so it had to be factored into the cost of the project. The problem we have is the inability of government representatives to do things right on their side. Since they are in charge of feasibility studies, they should do it well before bringing us in".

HAST: "some problems happen on site which we may not have envisaged and included in the preliminaries. The survey plans are quite old and do not give the exact topography of the land. So on site, we find out variances in the topography that warrant design changes. You know the initial cost is based on paperwork from the plan. Where we have assumed the house will come flat, there are variances in levels that is added cost. So these are all challenges".

- *Economic instability*

  CST: "Economic instability impacts on the market volatility coupled with inflation affects the cost estimate cost estimates during construction because of increases in material and labour costs."

  HAST: "Government economic policies sometimes affect the funds in circulation. These policies particularly affect an ongoing project as banks would not want to release money on time to contractors leading to problems in cash flow".

- *Political instability*

  CNT: "The political problems in the country sometimes affect the project. On one project, managing director of the housing authorities was changed up to four times before completion, and each director comes with its challenges that affect cost on the project".

However, a majority of the participants acknowledged that these factors have a minimal impact on cost control, which was negligible and happened occasionally. In a comment,

> ***CST***: "Well political instability is not a problem affecting cost control. So let's focus more on economic stability".

- *Community restiveness and burglary*

  CNT: The restiveness in the community from the lack of proper compensation is another challenge that affects cost planning and control. The community affected will not allow you gain access to the site, for site investigation before detailed designs can be produced. During construction also they break into the site and scatter works in progress or even demolish already completed works.

  CST: Dispute arising from community restiveness disturbs work onsite. The legal process costs almost N xxx million naira to pay off and repair things destroyed…this impact on the costs of the project because all the cost incurred would be summed up and reflect on the final project cost.

CNT: ….burglary is another problem if I tell you how much is lost from materials stolen from the site if we convert it in money (EXCLAIMS) it is much…. affects cost management during construction.

All the CNT participants interviewed corroborated this barrier as a problem affecting cost control.

Based on the comments of the participants the efficacy of the CMS were affected by both technical and implementation barriers.

4.4.4 Findings on Low-cost Housing Project Cost Management System

Findings from the interviewees with the HAST, CST, and CNT, clearly indicate that the techniques employed in the CMS are cost estimating, site meetings, cost reporting, cash flow, onsite resource control, cost scheduling, cost planning, target costing, and cost variance. Furthermore, two process approaches design-cost and control, and the cost- design -control approach are also used. The identified techniques and process approaches reveals that both modern and conventional CMS are employed in the CMS for LcH project delivery in the zone. A graphical illustration of two main CMS used is depicted in Figure 4.1.and 4.2.

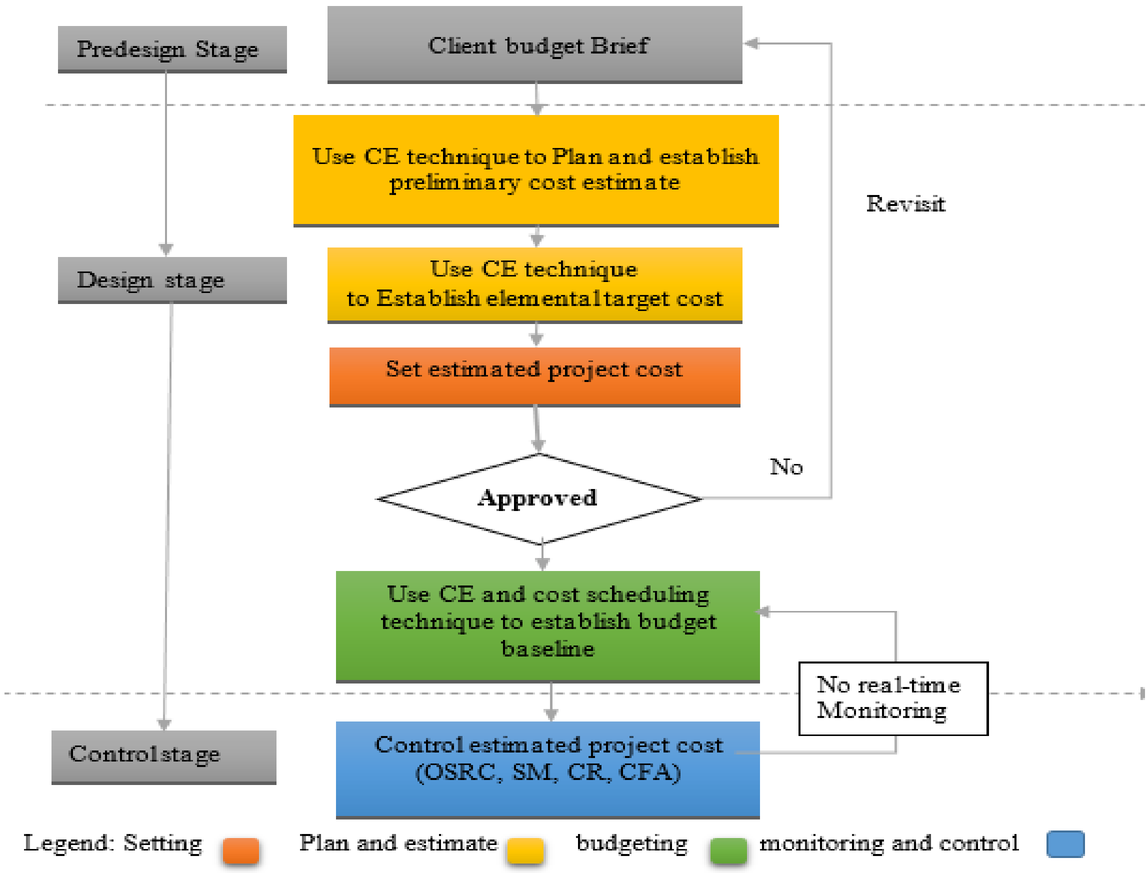


Figure 4. 1: PA, PC and PD Cost management system

Source: Researcher's field survey (2015)

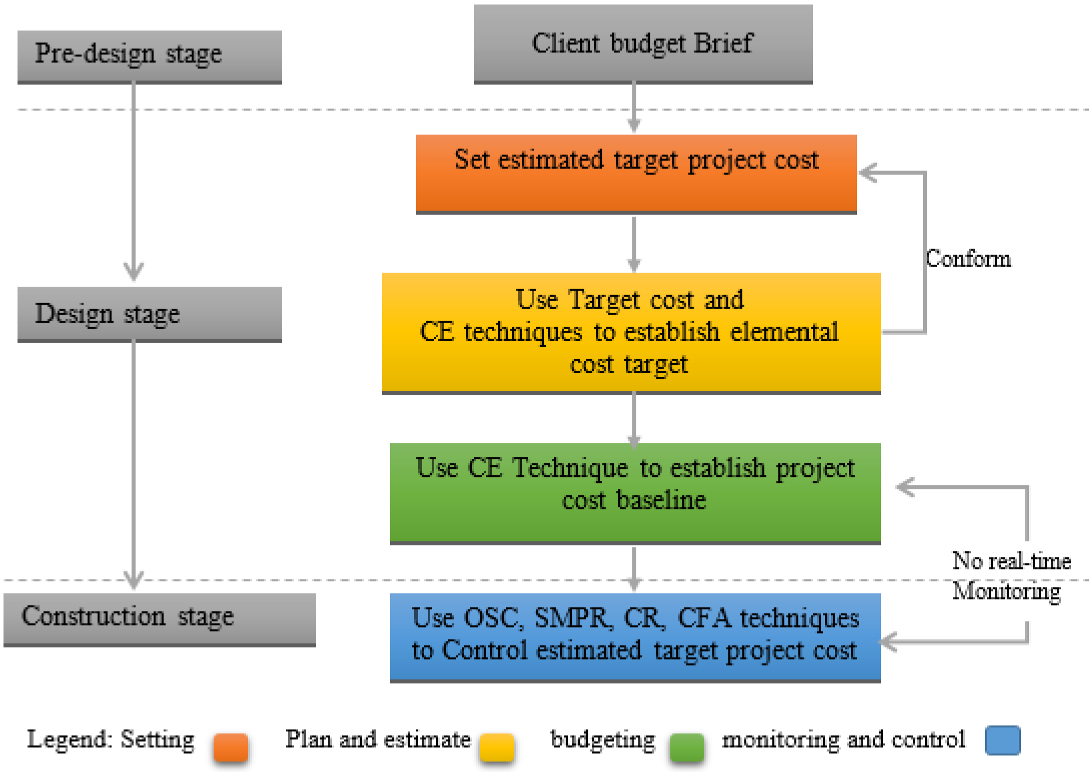


Figure 4. 2: PB Cost management system

Source: Researcher's field survey (2015)

Findings revealed that the current CMS for LcH project delivery faced certain limitations that affected effective process implementation. The current CMS lacked the capacity to aid effective project cost setting and planning affecting cost optimisation from design stage. It also experienced difficulty to effectively carryout real time monitoring of the project cost during construction. These constraints gave room to a lot of variations and design changes affecting cost planning and control as a result, unable to deliver effective cost performances. The constraints were attributed to the choice of inappropriate techniques unable to facilitate effective cost setting planning and real-time cost performances, poor implementation process including 17 implementation barriers acting on the CMS. Furthermore, the participants expressed concerns over the fact that the current CMS employed due to their constraints, are not able to deliver expected effective project cost performances in LcH project delivery. This findings on this theme indicate a relationship between ineffective CMS and poor cost performances and suggests that the CMS for LcH project delivery have both technical and implementation deficiencies.

4.5 DRIVERS FOR EFFECTIVE IMPLEMENTATION IN THE CMS

Findings from literature review identifies some generic drivers that can facilitate effective management and cost performances. This section documents the results of contextual investigations on the drivers necessary for effective CMS implementation. From the comments of the participants, 13 drivers were identified. These drivers include: clear and well developed client project brief, adequate and well detailed designs and specifications, effective project planning and supervision, competent design team, competent contractor, early contractor involvement, effective team collaboration, adequate and effective cash flow, stable economic environment, stable political environment, stable weather conditions, and adequate resolution of land compensation issues. On this theme, the expert opinions highlighting the 13 drivers are as presented.

- *Clearly and well-defined client brief*

  CST: "Government should negotiate with end-users and clearly state out the project requirements... not when designs have progressed then some more project requirement start to trickle in. A clear project brief will help the design team develop a cost effective design. Hazy briefs tend to influence poor design output".

  HAST: "...since we are not just providing houses for the market but for the target beneficiaries, it is our role as the government agency to clearly provide details of what is required in the project and what is available in the budget. This clarity will help the management team in effective planning of cost on the project".

  CNT: "Client should be more honest with what is available regarding funding to guide effective planning, designing and control of cost..."

These views conforms to those espoused by eight other participants across the HAST, CNT, and CST.

- *Effective cash flow on the project*

  CST: "Timely cash inflow is very important for us to management resources effectively on site. The housing agency and funding agencies should be prompt to release money for work done by the contractor to enable him to continue work immediately. This will help avoid fluctuation claims especially in our country where prices go up and never come down".

HAST: "Sometimes implementation is in stages so we ask the contractor to present advanced performance guarantee (APG) and therefore, contractors are paid upfront. This APG helps for effective cash flow to contractor though advance performance guarantee at every stage of work completed or about to start".

- *Availability of cost data*

HAST: "Availability of an effective data bank for cost information is also imperative as well…"

CST: "There is a need for effective cost data system for cost information it helps during approximate estimating. We must put that into consideration a means to collect feed-back on cost information from projects to help in future cost planning".

These views were corroborated in the comments of five other CST participants

- *Competent design team professionals*

HAST: "From my experience, LcH projects are well challenging so to make the job much easier, both the design team and the contractor should have competent professionals with previous experience and particularly as regards managing costs…to deliver effective project estimates and budgets".

HAST: "We need competence hands to make work go smoothly. So a right design team will facilitate the good choice of the right contractors to be engaged to achieve effective cost management. The technical competence of all the design team and contractor team professionals is paramount from the early stage where cost effective design and specifications needs to be developed, to the construction stage where controlling the costs is essential",

CST: "There is a need for the key actors like the architect, engineer and quantity surveyor to be knowledgeable in cost management for easy flow and collective reasoning on appropriate tools to use as there is no widely adopted guide on how cost should be managed from the beginning to the closeout of the project."

CNT: "When the team is made up of experienced professionals who have the right background and knowledge on this type of project they can give right advice on how to manage costs throughout the project. But when builders, for example, are employed to do the job of a quantity surveyor problems are bound to be encountered…the professionals should take full responsibility for whatever cost implication on the project where they did not discharge their duties properly".

These views were corroborated in the comments all other participants from the HAST, CNT and the CST.

- *Competent contractor team*

HAST: "The efficiency of the skill and output of the workers engaged is vital to the quality and quantity of work out on site. Having a work plan without productive workers makes the job messy… motivation through training on material handling and usage to avoid waste. Provision of onsite management support and effective information and communication to the workers on work expected is necessary to improve their output on the site".

CST: "Looking at technical capacity of workers is important for project cost control; the contractor needs to engage experienced and competent site supervisors and not engaging incompetent workers to pay back political favours".

CST: "Training of the workforce is also necessary it will enhance efficiency and productivity of the workmen and technical staff. Although it may cost money to train them, however, it will improve their efficiency, certainly reducing waste and its cost impact on the long run".

These views were in consensus with all the views of the participants from the HAST, CNT and the CST.

- *Effective team collaboration and commitment*

HAST: "Effective collaboration involves effective communication, information flow, and coordination. Given the budget constraints on LcH projects, there is a need for commitment and teamwork of all the members in effective cost management".

HAST: "An interest of the successful delivery and adhering to the common project objective will promote honesty amongst the project team members and eliminate corrupt practices."

CST: "agreement between the team members will facilitate channels of communication and management."

CNT: "Coordination and collaboration of project team members helps to proffer proper ideas that can help the choice of techniques to employ to manage cost. Errors in designs and estimates can easy be mitigated and organisational bureaucracy of project functions minimised".

These views were in agreement with comments of all the other participants from the HAST, CNT and the CST.

- *Effective project planning and supervision*

HAST: "Proper site supervision will assist in cost control of materials, labour, plant, contractor overheads. When these costs are efficiently controlled in line with the cost target then there will be no need to incur additional costs".

HAST: "Effective site supervision, will mitigate waste from substantial cost components like Materials and labour. Waste can lead to higher project costs…both the consultants and contractors must put heads together in effective supervision to prevent waste".

CST: "An effective project planning is essential for the smooth running of the project. Project planning is a continuous process until completion; so updating the schedules and the costs baseline is important to ensure that the project is performing to expectation per time. As consultants incorporating any changes in the budget and modifying the work plan makes work supervision much easier".

These views were corroborated in the comments of all the other participants from the HAST, CNT and the CST.

- *Well detailed design and specifications*

  HAST: "There is a need for well-detailed designs and specifications. Therefore, adequate time should be made available to carry out proper site investigations that will enable proper designs and detailed specifications to mitigate construction waste that may arise"

  CNT: "Proper designs lead to fewer variations during construction. Therefore adequate design development should be considered to avoid the problematic issues that can affect accurate estimates and cost control".

These views were corroborated in the comments of fourteen participants from the HAST, CNT and the CST.

- *Early contractor involvement*

  CNT: From my experience on PD and other projects, all the professionals that make up the project team should be involved in all the stages of the cost management process. So if it means engaging the contractor early then so be it. But when all the teams are not there from the start it is more difficult to manage cost.

This view was in agreement with views by all CNT and three of the CST participants.

- *Stable weather conditions*

  CST: "It is important for the contractors to have a backup plan against the effect of adverse weather conditions during the construction."

  CNT: "A stable weather condition will facilitate work progress on site. Where possible constructions should be planned around, dry seasons were we have more stable weather than during raining seasons".

This comment was in agreement with comments from six other participants from the HAST and CNT.

- *Adequate resolution of land compensation issues*

  CNT: "Adequate resolution of land compensation issues will mitigate delays, vandalism, and disruptions by community youths, which may affect cost control during construction."

  CST: "If community problems are envisaged government should try to handle them before finishing acquisition because it will affect the construction stage of the project. It is a cause of waste because it is something that can be avoided. The government should solve this problem".

These views were in consensus with views of all the participants from the HAST, CNT and the CST.

- *Stable Economic and Political Environments*

  CNT: "Government has a political will to ensure that the projects initiated are completed as expected by addressing through policies the general economic perspective and minimise inflation or subsidies cement or regulation of market prices."

These views were in consensus with views of the eight participants from the HAST, CNT and the CST.

Based on the comments of the HAST, CST, and CNT their comments clearly indicate that to improve effective implementation of the techniques and process within the CMS, will require a consideration of the 13 drivers identified.

4.6 MEASURES NEEDED TO IMPROVE THE EFFICACY OF THE CMS

One of the objectives of the study is identifying measures to improve the current CMS in use. Based on the discovery on the constraints of current CMS affecting cost performance outcomes, the researcher sought to identify measures for improvement. The participants from the CST, HAST, and CNT unanimously acknowledged that there is a need for some new techniques to be adopted. They also emphasised the need to adopt the cost-design- control approach and integration of the drivers needed for effective implementation of the system. These measures are highlighted in their comments.

4.6.1 Integration of Modern Cost Management Techniques

To improve the technical parameter of the CMS, the participants identified some modern techniques. In their comments:

> ***HAST:*** "Target costing, assisted in improvements on PB compared to previous projects. This method was effective and appropriate to set project target cost and plan within the cost. However, we still have challenges in implementation because I think the project team may not properly carry it out. I also think that employing techniques that facilitate designing to a cost rather than costing to a design approach would be more appropriate for this kind of projects".

> ***CST:*** "Target costing method is ideal particularly for LcH projects. LcH project budget is usually very tight. Though currently, employing this method is challenging because we are not very certain on how we are executing it and poor awareness. Furthermore, the project team keep changing from project to project making knowledge transfer difficult too. However, with target costing, cost planning and cost estimating we can effectively plan cost".

> ***CST:*** "Techniques like cost estimating and cost planning are effective to provide the likely cost and cost plan at the design stage. However, during construction, in ensuring that we put proactive means to make sure that the cost does not exceed what is in the bills, the contractor can use other effective techniques to prevent waste site resources. Effective onsite resource management is necessary which aids the contractor quantity surveyor in effective time study, inventory control to prevent material waste".

> ***CST:*** "We need to reinforce our cost control methods to minimise cost at all levels. We need to re-engineer the design cost control techniques such as target costing which we are still trying to use. We also need to be proactive because an effective system will assist the team plan and control cost on the project and deliver within client budget it is very, very important. He further suggested that the EVA technique can be integrated as an improvement strategy particularly for cost monitoring and controlling that is if other

team members can see it as relevant. I have used it on a private project, and it was of good assistance".

CST: "Contemporary cost management practice have gone beyond traditional cost control, cost scheduling or reconciliation. Sometimes it depends on the project management input and you know some of these members have an attraction to traditional cost control. However, I think we should try our hands on EVA. With a cost management control tool like the EVA monitoring, weekly variance analysis can be more effective".

CNT: "For cost control, variance analysis I think will help in monitoring performances as work is ongoing which is useful for control purposes. Therefore, I believe if the quantity surveyors are very competent with these methods we can have improvements".

CNT: "I heard cost variance analysis or earn value analysis can be more effective to monitor performances as work is ongoing. I am not very aware of their procedures but I think we can try to use these methods with what we have and see the outcome".

HAST: "We need to adopt other effective techniques available. If there are other methods or tools, you think you can proffer we are open to such to improve our cost performances".

Based on their comments, TC and EVA were additional key techniques recommended to improve the CMS.

4.6.2 Implementation Success Drivers

To improve the control parameter of the CMS, the participants identified consideration of the success drivers for effective implementation. In one of their comments:

CST: "Factors like lack of awareness, poor collaboration and what may contributed to poor cost management experience. Therefore, employing knowledgeable professionals, project planning, detailed design collaboration, and other factors I earlier listed can help us to employ the techniques effectively and improve the cost management process. They should be given appropriate consideration I believe".

This comment was in consensus with those espoused by all the other participants interviewed

4.6.3 Other Emerging Themes

Furthermore, all the participants remarked that the improvement on the system would need to focus on managing project costs not only at the construction stage but more effectively from the early design stage. This was established in their comments.

> ***CST:*** "In achieving effective cost management the early design stage I needs to be critically considered this is because it is where a lot of decision affecting cost is made. The design stage is the most critical stage that can significantly affect effective cost management. So any mistake from design will significantly influence the final construction cost of the project. Then the construction stage is the second because there is need to manage the construction cost of the projects because of its significant impact on the total delivery cost of the project".

> ***CST:*** "…the way we manage cost need to improve. There certain aspect of the execution that we keep doing afresh for each projects and it suggests we do not have a model or standard that helps us to know the right method to adopt. Well, it is unfortunate we just doing trial and error. Although we are in a developing country we need to get to the point, we have models or checklists that guide effective cost management and not just in cost alone but entire project management. That is how it is done in many developed countries".

> ***CST:*** "We should have something like a checklist or guide showing the appropriate method and way cost can be planned and controlled to aid good coordination and collaboration of all the team members."

4.7 BENEFITS OF EFFECTIVE CMS FOR LCH PROJECT DELIVERY

Findings from literature review identify common benefits of employing effective CMS. This section documents the results of contextual investigations on the benefits of an effective CMS in LcH project delivery in the Nigerian southeast zone. Five benefits were identified from the comments of the participants.

HAST: "One main advantage of having an effective system is that it will help cost budgeting, planning and control during construction. The truth is that if the system is very effective, then effective cost performances on the project is guaranteed".

HAST: "It can help the team to deliver the project at reduced cost without compromising quality."

CST: "An appropriate CMS should basically help the project team to forecast and plan what the project will cost and how it can be controlled within the budget… it should also assist in achieving improved cost performance giving clients' better value for money".

CST: "It helps to articulate cost data that can be useful for future project since LcH projects are prototypes."

CNT: "Effective cost management is everything put together… client want quality houses at cheap cost, contractors are here also to make profit. So if the CMS is effective, we can deliver the project at reduced costs and improve our chances for more profit…"

CNT: "It can help to improve cost performance of the project within the clients' budget and most importantly at affordable costs to the end-users."

The views of many of the other participants interviewed were in conformity with these comments.

Based on the comments from the HAST, CST, and CNT, an effective CMS for LcH project delivery is expected to facilitate effective cost management, improved value for money, effective LcH project cost performances, effective cost feedback for future projects, and improved client satisfaction.

4.8 SUMMARY OF QUALITATIVE FINDINGS

The following findings are drawn based on the analysis of the semi-structured interviews conducted with the HAST, CNT, and CST from the case study reporting on the themes: LcH project delivery, project cost management system, and implementation drivers.

- The LcH project delivery process consist of four main stages: predesign, design, tendering and documentation, and construction stages
- Both design bid build and design build procurement system are popularly adopted in LcH project delivery in the Nigerian southeast zone
- Achieving effective project cost performance is a highly prioritised criterion by project sponsors and PMT in LcH project implementation.
- The techniques identified for use within the CMS for LcH project delivery are cost estimating, site meetings, cost reporting, cash flow, onsite resource control, cost scheduling, cost planning, target costing, and cost variance.
- The CMS for LcH project delivery employs both design-cost-control and the cost-design-control process approaches.
- The current CMS employed is not suitable to deliver effective cost project cost performances. Hence, there is a relationship between ineffective CMS and poor cost performances.
- Current CMS employed have difficulty in effectively set, plan and carry out real-time monitoring of project cost performances during construction. These constraints give room for variations with negative cost implications, in addition, make cost optimisation difficult to achieve on the project.
- Factors influencing the poor efficacy of the CMS were attributed to the choice of inappropriate techniques and the presence of 17 implementation barriers influencing the process approach.
- Implications to improve current CMS, include the adoption of TC, and EVA to reinforce outcomes at the setting, planning and controlling process stages. In addition, thirteen success drivers for effective CMS implementation need to be considered. The drivers identified include clear and well-defined client project brief, effective cash flow, availability of cost data, competent design team professionals, competent contractor management team, effective collaboration, well-detailed design and specifications, adequate land compensation to communities, stable weather conditions, and stable political and economic environment.

- The lack of a framework for cost management is a challenge for the PMT. Given that, the PMT change from one project to another, and to capture the knowledge and feedback from past project to future LcH project can be difficult. Hence the need for a CMS framework or model.
- Effective consideration should be given to the early design stages decisions that significantly affect the performance outcome of the CMS.
- The benefits of an effective CMS include improved cost management, improved value for money, effective LcH project cost performances, effective cost feedback for future projects, and improved client satisfaction.

4.9 CHAPTER SUMMARY

This chapter presented the analysis and results of the qualitative data collected from the case study on the following themes: LcH project delivery, CMS, implementation drivers and improvement measures. Some of the key findings of this chapter is the identification of 7 techniques, 2 process approaches employed in the CMS and 17 barriers affecting effective CMS implementation. Other findings include adopting TC and EVA to existing effective techniques and consideration of 13 implementation drivers to improve current CMS in use. Also, the need for a well-developed framework cum model to assist the PMT in effective cost management and improve cost performances of LcH project delivery. These qualitative findings presented in this chapter were used to develop the questionnaire as a platform to highlight the precise variables needed further investigation and confirmation. The questionnaires were distributed to PMT members operating in the Nigerian southeast zone and the analysis and results are presented in the next chapter.

CHAPTER FIVE
QUANTITATIVE DATA ANALYSIS AND RESULTS

5.1 INTRODUCTION

The key findings from the analysis and results of the qualitative phase were subject to further investigations by a wider pool of PMT members involved in LcH project delivery within the zone using questionnaires. This chapter presents a step-by-step account of the analysis and results of the quantitative data collected via questionnaires from respondents in the case study. It covers quantitative findings on the confirmation and verification of the specific variables relating to the LcH project delivery, CMS characteristics and the IMSF. Both descriptive and inferential statistics summaries are used to analyse the results of the categorical and ordinal data from the questionnaires and presented using tables and charts. It is expected that from the findings of the analysed quantitative data, the specific variables to conceptualise the CMSM will be clearly identified. Besides, the following propositions will be tested using the findings from the questionnaires for confirmatory purposes:

- Ineffective CMS influences poor LcH project cost performances
- The choice of techniques and process approach influences the efficacy of the CMS to achieve expected performance outcomes.
- The current CMS need both technical and implementation improvement for effective outcomes.
- Certain IMSF are pivotal to maintain effective and viable CMS implementation.

The chapter is structured as follows:

- Empirical Demography of Respondents
- Project cost performance and project cost management system
- Implementation success factors (IMSF)
- CMS Constraints and Improvement measures

- Summary of quantitative findings from case study

5.2 CHARACTERISTICS OF RESPONDENTS

The researcher alongside the recruited gatekeepers purposively reached and successfully distributed 249 questionnaires to 83 PMT organisations across the Nigerian southeast zone. 144 questionnaires were filled and returned accounting for a total response rate of 57.83%. The empirical demography of respondents was explored, presented, and described in this section. The analysis is in the same sequence as the questions were laid out in the questionnaire. The questions covered the respondent's organisation and personal involvement in LcH project delivery in the Nigerian southeast zone.

5.2.1 Organisations' Role in LcH Project Delivery

Respondents were asked to indicate the role of their organisation in LcH project delivery. Results, as shown in Figure 5.1, reveal that 18.1% of the respondents worked in the housing agency, 39.6% with the consultancy organisations, and 42.4% with the contracting organisation. These affirm that the views of the HAST, CST, and CNT will be clearly represented.

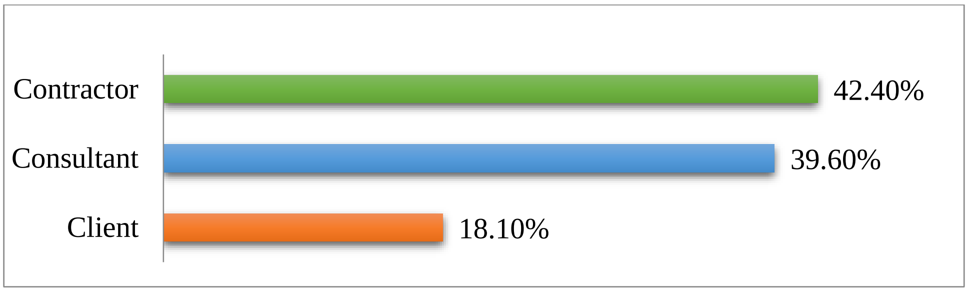


Figure 5. 1: Respondents' organisational role in LcH project delivery

Source: Researcher's field survey (2015)

5.2.2 Organisations' Experience in LcH Project Delivery

Results of respondents organisation's length of experience in the LcH project delivery in the zone is shown in Figure 5.2, reveal that 26.4% of the respondent's organisations had a minimum of 15 years' experience, 38.2% above 10 years but less than 15 years' work experience, 21.5% above 5 years but not up to 10 years' experience, and 13.9% less than 5 years' experience.

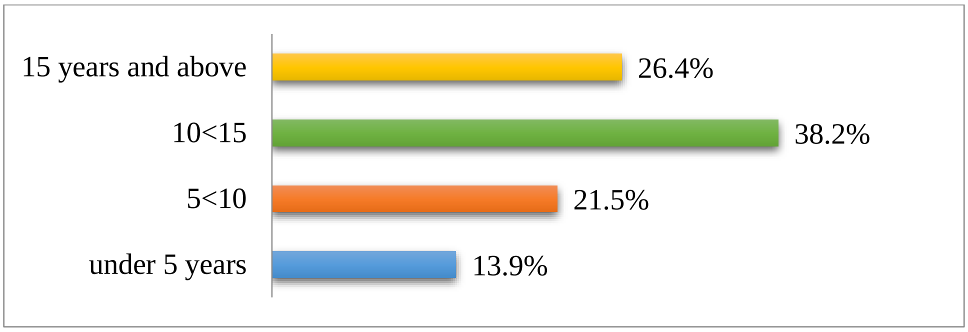


Figure 5. 2: Respondents' organisation experience on LcH project delivery

Source: Researcher's field survey (2015)

5.2.3 Respondents Professional Role

Figure 5.3, show the result of the analysis of respondents' professional role. As shown 30.6% of the respondents were architects, 25.7% quantity surveyors, 4.9% were builders and 38.9% were engineers.

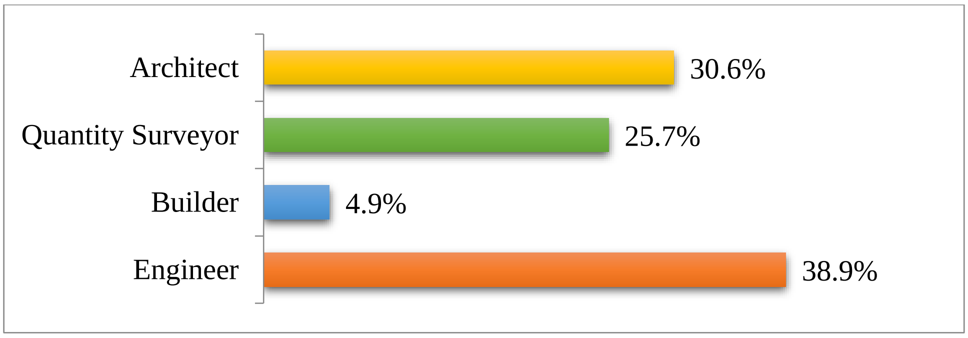


Figure 5. 3: Respondents' professional role

Source: Researcher's field survey (2015)

5.2.4 Respondents Educational Qualification

Results for the educational qualification of the respondents is shown in Figure 5.4. Results reveal that the majority, 61.8 % had MSc, MEng, Mtech degree (post graduate level qualification), and 31.30% a graduate level degree of BSc, BTech, BEng. 6.9% of participants had a qualification below a bachelor's degree or equivalent of higher national diplomas HND.

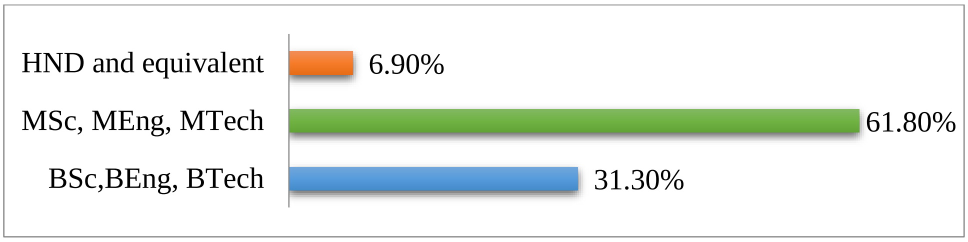


Figure 5. 4: respondents' educational level

Source: Researcher's field survey (2015)

5.2.5 Respondents Involvement in Federal and State Level LcH Project delivery

Results on respondents involvement in the type of LcH projects is shown in Figure 5.5. 3% of the respondents had been involved in only federal government led LcH projects, 60% on state government led LcH projects and 37% on both state and federal government led LcH projects.

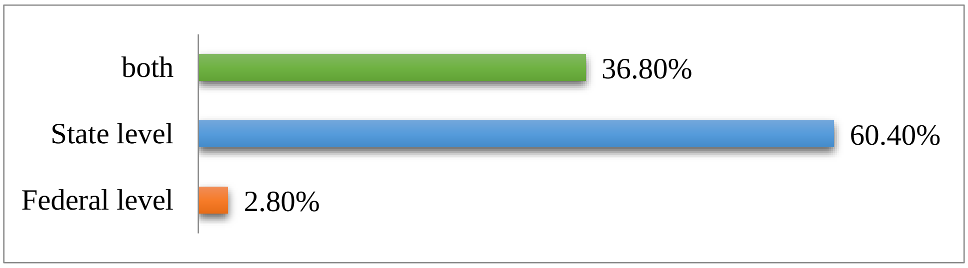


Figure 5. 5: Involvement in Federal and State-led LcH projects

Source: Researcher's field survey (2015)

5.2.6 Respondents Length of experience in Low-cost Housing Project Delivery

Figure 5.6, show the result of the analysis of the years of experience of the respondents. As shown 18.8% of respondents had above 15 years of experience, 43.8% between 10- 15 years' experience, 27.1% between 5 and 10 years, and 10.4% less than 5 years' experiences in LcH project delivery.

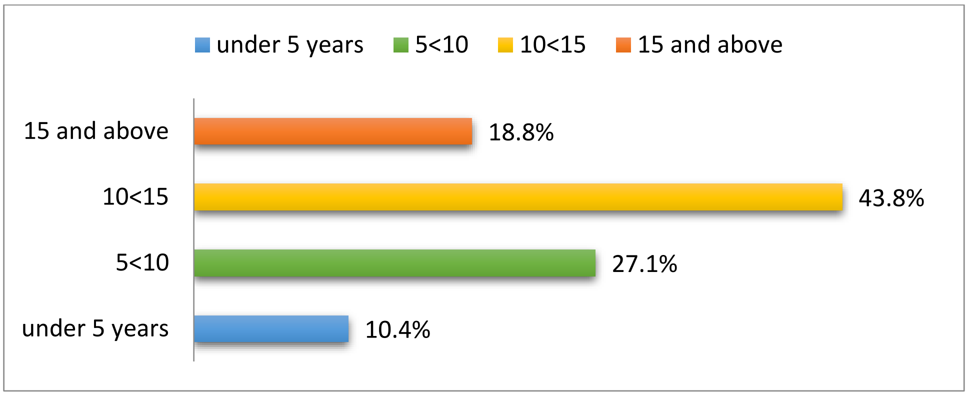


Figure 5. 6 respondents' years of experience in LcH project delivery

Source: Researcher's field survey (2015)

5.2.7 Knowledge on project cost management practice in Low-cost Housing Project Delivery

On knowledge of project cost management practice in LcH project delivery, the respondent, as shown in Figure 5.7, 26% acknowledged that they were very knowledgeable, 53% acknowledged that that were knowledgeable, and 21% acknowledged that they were somewhat knowledgeable.

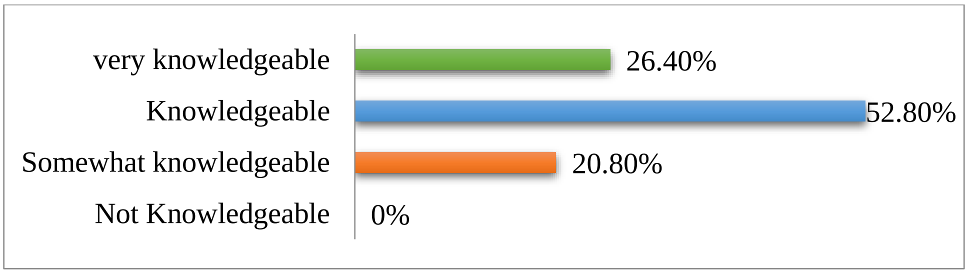


Figure 5. 7: knowledge on project cost management practice on LcH project delivery

Source: Researcher's field survey (2015)

5.2.8 Findings on Low-cost Housing Project Cost Management System

The findings from the analysis on background information of the respondents clearly indicate that there is a balanced distribution within the sample representing the HAST, CST, and CNT. The professional backgrounds of the respondents were architects, quantity surveyors, builders and engineers though the percentage of builders' respondents was lower.,. This low percentage of builder respondents is traceable to the low population of registered builders attributed to the year of establishment of the Nigerian institute of building (NIOB) in 1970 and its registration board in 1990. The results in this section also show that all the respondents had a minimum of graduate level university degree and an average of 10 years' experience in LcH project delivery. In addition, all the respondents have a level of knowledge in cost management of LcH projects and had been involved in either state level, federal level led projects or both in the zone. Based on this discovery, it can be justified that the respondents are well informed and possess relevant knowledge useful to gather primary data to achieve the research aim and objectives.

5.3 PROJECT COST PERFORMANCE AND COST MANAGEMENT SYSTEM

This section presents the results on the analysis of the questions associated with project cost performances and the efficacy of the CMS in current use for LcH project delivery in the Nigerian southeast zone.

5.3.1 Reliability of Constructs

Reliability of constructs is determined by measuring the internal consistency of the data collected. The results reflected a Cronbach alpha of 0.789 showing consistency between the answers on 28 items. This result reflects the reliability of the construct is considered acceptable. Table 5.1 below shows the reliability statistics.

Table 5. 1: Reliability Statistics on project cost performance and CMS characteristics

Questions	Cronbach's Alpha	Number of Items
Project cost performance and cost management system characteristics	**0.789**	**28**

5.3.2 Low-cost Housing Project Cost performance

This question requires respondents to confirm their level of agreement that effective project cost performance is a highly critical criterion that measures LcH project success of the project sponsors in the southeast zone. Regarding this question, as shown in Figure 5.8, 78.5% of respondents strongly agree, and 21.5% agree that effective cost performance is a highly critical criterion for LcH project success.

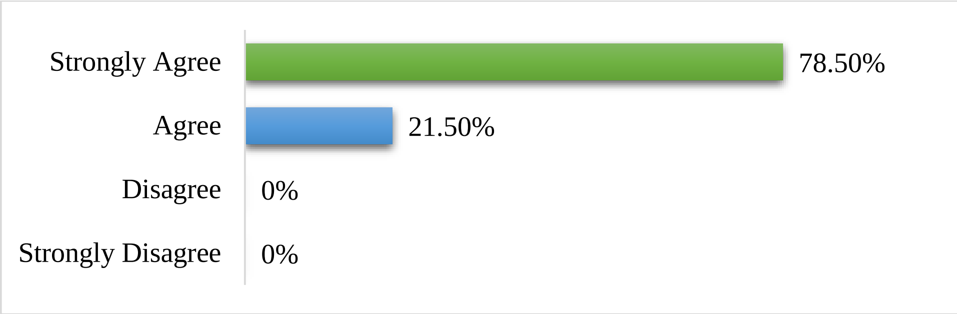


Figure 5. 8: Effective project cost performance as critical success criterion

Source: Researcher's field survey (2015)

5.3.3 Influence of CMS on LcH Project cost performances

This question seeks to affirm the influence of CMS on project cost management and performances. The result from Figure 5.9, shows that 43.10% rated the CMS to have a very high influence on project cost performances. 38.90% f respondents rated the CMS of high influence, while 18.10% rated less influence on project cost management and performances.

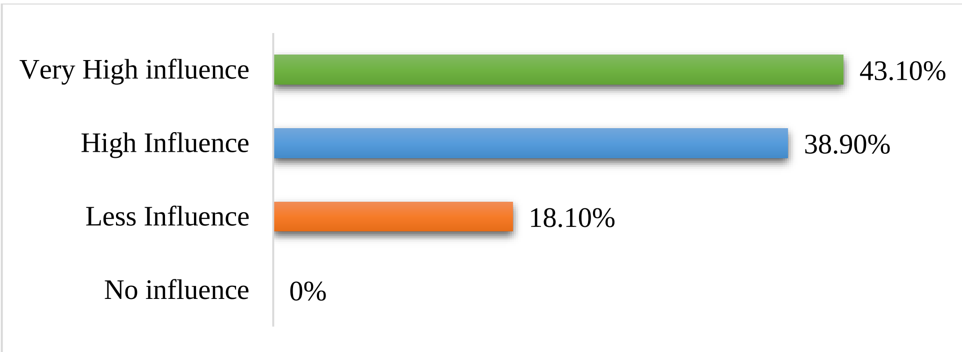


Figure 5. 9: Influence of ineffective CMS on poor LcH project cost performance

Source: Researcher's field survey (2015)

5.3.4 Involvement of PMT in CMS Implementation in LcH project delivery

The results of the questionnaire survey on the level of active involvement of the PMT in project cost management is shown in Figure 5.10. Results show that 9% of respondents indicated that the CNT is fully involved, 34.7% indicated that the CNT is involved, and a majority 56.3% agrees that the CNT is somewhat involved in the CMS implementation in LcH project delivery. Results on CST level of involvement show that 47.20% agrees that the CST are fully involved, 43.8% indicated CST are involved, and only 9 % indicated that CST is somewhat involved in the CMS implementation in LcH project delivery. Regarding the level of client involvement, result show 29.20% indicated HAST full involvement, 50% indicated HAST is involved, and 20.8% indicated HAST is somewhat involved in the CMS implementation in LcH project delivery. These results show that the CST have a higher level of involvement, followed by the HAST and lastly the CNT in the CMS implementation in LcH project delivery.

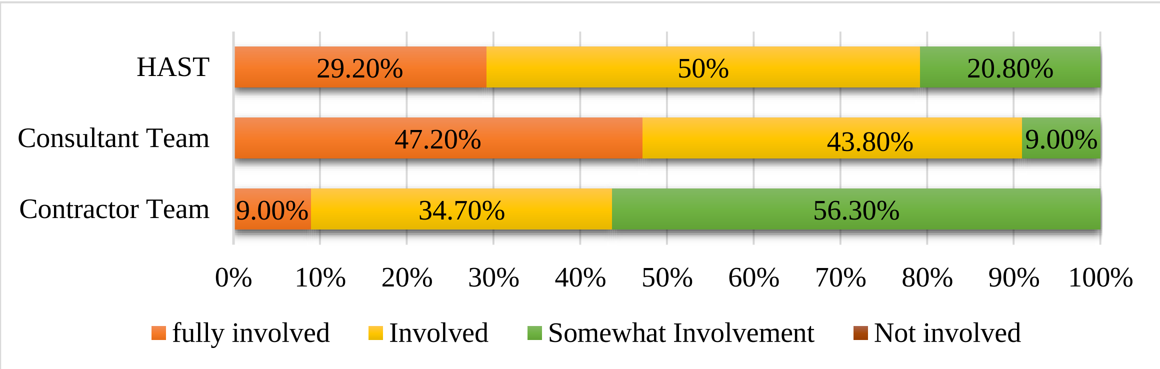


Figure 5. 10: Project management team involvement in cost management practice

Source: Researcher's field survey (2015)

5.3.5 Cost Management Techniques

These questions seek to investigate the frequency of use of techniques identified from the semi-structured interviews.

5.3.5.1 Efficacy of the techniques in project cost management.

Figure 5.11 reveals that 36.1% of the respondents strongly agree, and 63.9% of the respondents agree that all the techniques identified are effective when appropriately employed in the cost management process.

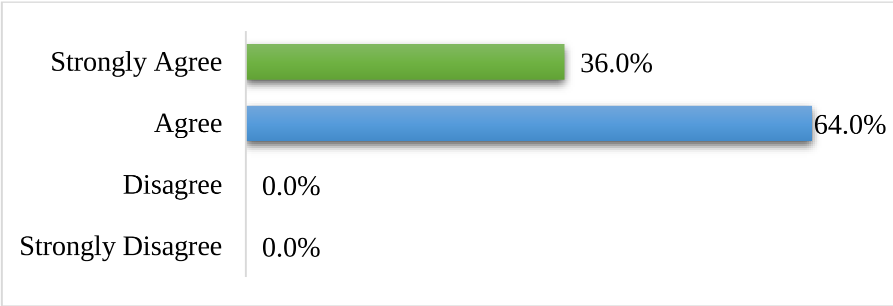


Figure 5. 11: Effectiveness of techniques

Source: Researcher's field survey (2015)

5.3.5.2 Frequency of use of each identified technique

Based on the analysis of the frequency of use of the identified techniques, the RII score across the respondents reveals the results as presented in Table 5.2. The results show that cost estimating is the most frequently used technique; ranking 1st with an RII of 0.92. Rankings of other techniques in descending other show that onsite resource control 2nd with a score of 0.87, cash flow 3rd with a score of 0.86, site meetings and performance reviews 4th with a score of 0.85, and cost reporting 5th with a score of 0.82. Cost Planning, cost scheduling, cost variance with RII of 0.693, 0.69 and 0.65 ranked number 6, 7 and 8; while earning value analysis and target costing with RII of 0.58 and 0.53 ranking 9th and 10th were the least used techniques. The Kruskal-Wallis test was used to examine any significant difference in the perception of responding groups on the techniques. Based on the Kruskall Wallis test results, all the techniques except site meeting report, obtained a Asymp. Sig. > 0.05. This indicates that the perception of all the respondents from the responding groups has no significant difference on the techniques identified. However, on the site meeting report the consultants level of agreement on site meetings as a cost management technique was low in comparison to the HAST and CNT perspective.

Table 5. 2: Rankings on techniques in use

Techniques	N	RII	Rank
Cost estimating	144	0.917	**1**
Onsite resource control	144	0.870	**2**
Cash flow analysis	144	0.855	**3**
Site Meetings	144	0.850	**4**
Cost reporting	144	0.823	**5**
Cost Planning	144	0.693	**6**
Cost scheduling	144	0.690	**7**
Cost variance	144	0.650	**8**
Earn value analysis	144	0.585	**9**
Target costing	144	0.523	**10**

Source: Researcher's field survey (2015)

Table 5. 3: Kruskal-Wallis test on CMS Techniques use

S/n	Cost management techniques	Chi-Square	Df	Asymp. Sig.
1	Cost Planning	0.305467	2	0.858358
2	Cost estimating	3.047567	2	0.217886
3	Cash flow analysis	3.756469	2	0.15286
4	Target costing	0.355928	2	0.836972
5	Onsite resource control	5.225413	2	0.073336
6	Cost variance	1.661561	2	0.435709
7	Site meeting	11.01687	2	0.004052
8	Earn value analysis	1.812533	2	0.40403
9	Cost reporting	0.889694	2	0.640922
10	Cost scheduling	6.510985	2	0.038562

Source: Researcher's field survey (2015)

The results Table 5.2 and 5.3 confirms that conventional techniques are predominant in the CMS currently used for LcH project delivery within the zone. The next section presents the results of the questionnaire survey regarding the perceptions of respondents on the CMS process.

5.3.6 Cost Management Process

This subtheme seeks to affirm the findings of the semi-structured interviews on the CMS process employed on the LcH project delivery.

5.3.6.1 Stages of the cost management process

- ***Setting stage***

Figure 5.12 show that 43.06% of the respondents strongly agree and 45.83% agree that setting the project target cost is a stage in the cost management process. However, 11.11% disagree.

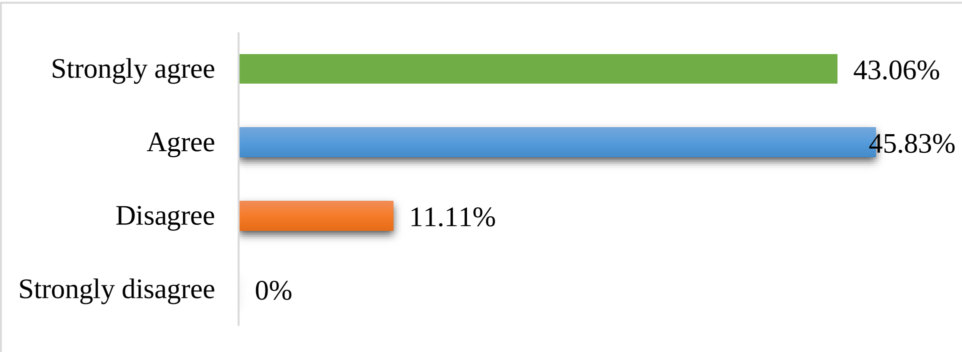


Figure 5. 12: Setting stage

Source: Researcher's field survey (2015)

- ***Planning and estimating stage***

From Figure 5.13, a majority 68.75% of the respondents strongly agree and 27.08% agree that planning the cost is a stage in the cost management process. However, 4.17% disagree.

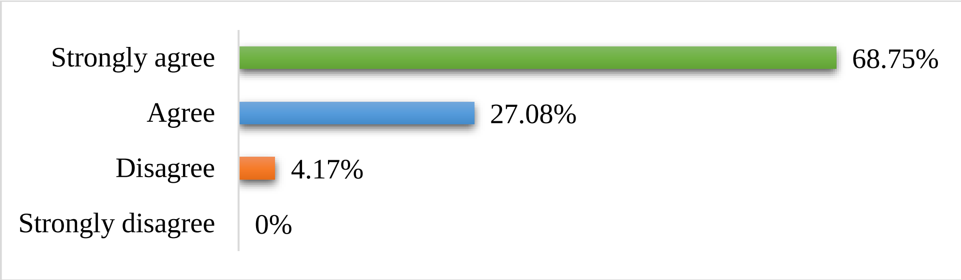


Figure 5. 13: Planning and estimating stage

Source: Researcher's field survey (2015)

- ***Budgeting stage***

Figure 5.14 show that a majority of the respondents representing 54.17% strongly agree and 41.47% agree that budgeting is a stage in the cost management process. However, 4.17% disagree.

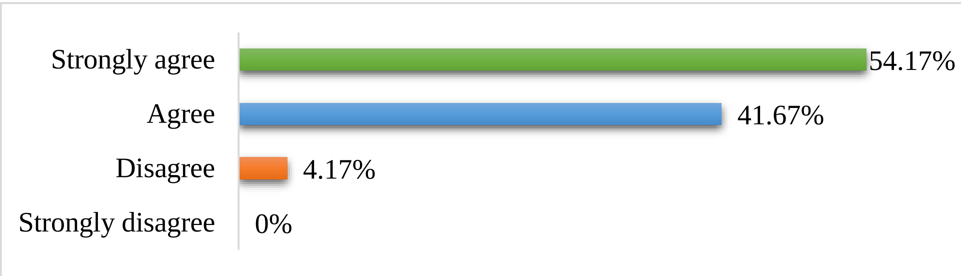


Figure 5. 14: Budgeting stage

Source: Researcher's field survey (2015)

- ***Monitoring and control stage***

As shown in Figure 5.15, 88.90% of the respondents strongly agree and 11.11% agree that this stage is part of the cost management process. There was no disagreement by the respondents.

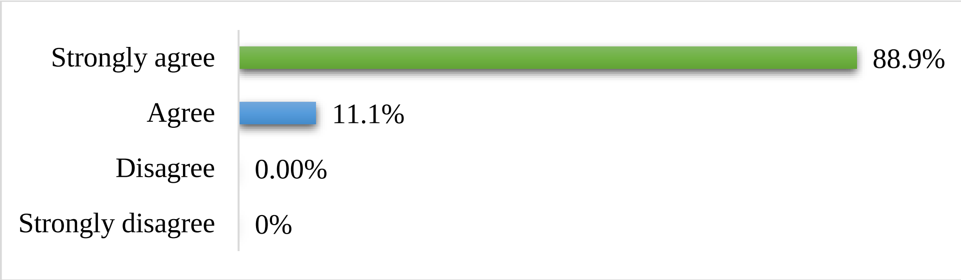


Figure 5. 15: Monitoring and Control stage

Source: Researcher's field survey (2015)

5.3.6.2 Process approach

Two process approaches were identified from interview findings and these questions in the questionnaire seeks to affirm the frequency of their use in the CMS in LcH project delivery.

- ***Design-cost-control approach***

This question design- set- control process approach identified from the qualitative findings. The result as shown in Figure 5.16 reveals that 63% rated the usage of this approach as always, 32% say it is often used; while 5% say it is rarely used.

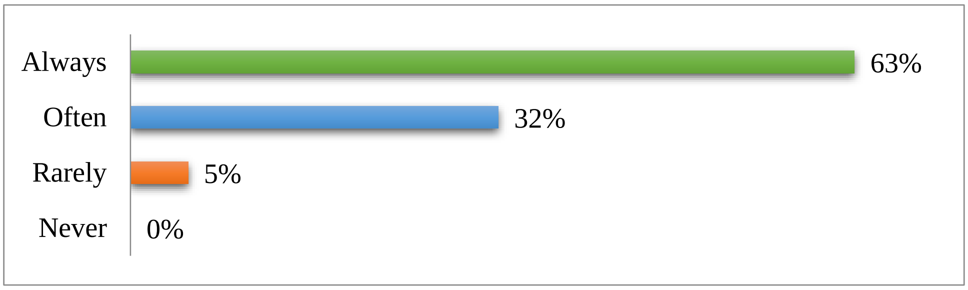


Figure 5. 16: Design-cost-control approach

Source: Researcher's field survey (2015)

- ***Cost- Design -Control approach***

This question seeks to affirm the frequency of use of the cost-design-control process approach identified from the qualitative findings. The result as shown in Figure 5.17 reveals that 9% rated the usage of this approach as always, 26% say it is often used; while 65% say it is rarely used.

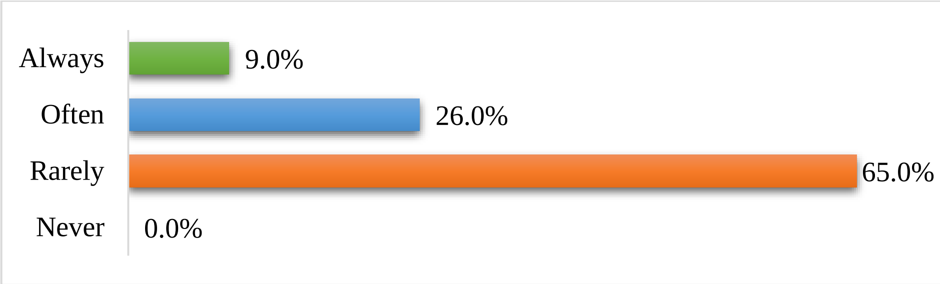


Figure 5. 17: Cost-design-control approach

Source: Researcher’s field survey (2015)

5.3.7 Benefits of Effective Cost Management System in LcH Project Delivery

Based on the findings of the qualitative data analysis, this section seeks to further investigate and affirm the benefits of effective CMS on the LcH project delivery.

5.3.7.1 Leads to effective project cost management on Low-cost Housing projects

Figure 5.18 show the analysis of respondents’. The reveals that a majority representing 81.9 % of the respondents strongly agree and 18.1 % agree that effective CMS will lead to effective LcH project cost management.

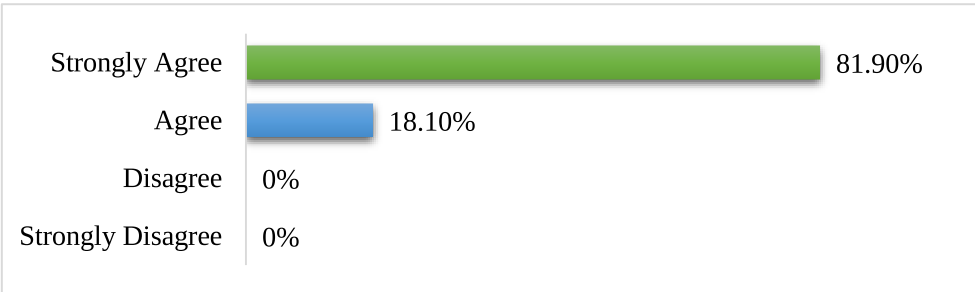


Figure 5. 18: Improved LcH project cost management

Source: Researcher’s field survey (2015)

5.3.7.2 Improved Client Satisfaction

Figure 5.19 shows that analysis concerning the benefit effective CMS on attaining client satisfaction. Results show that 41% indicated strong agreement while 59% indicated agreement that an effective CMS leads to improved client satisfaction. There was no level of disagreement to this qualitative finding from the respondents.

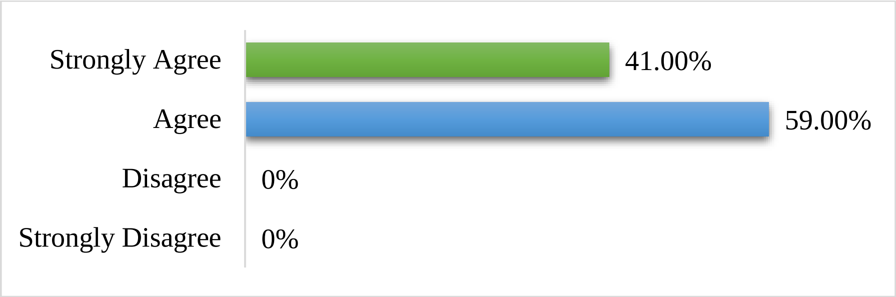


Figure 5. 19: Improved Client satisfaction

Source: Researcher's field survey (2015)

5.3.7.3 Leads to effective cost performances

Figure 5.20 shows that 77.8% of the respondents strongly agree while 22.2% agrees that an effective CMS will lead to effective project cost performances. There was no level of disagreement to this qualitative finding from the respondents.

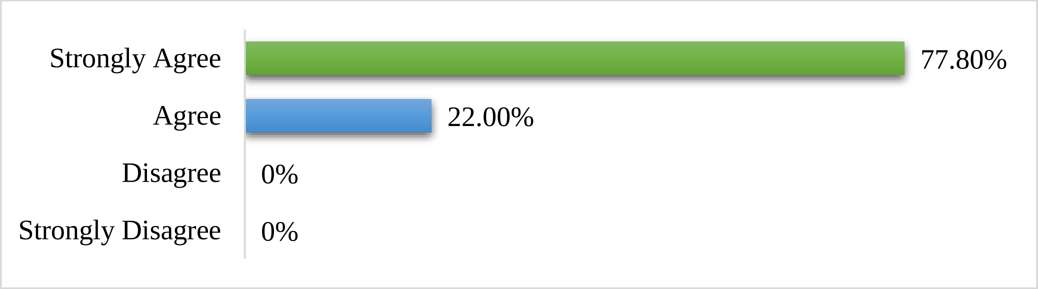


Figure 5. 20: leads to effective cost performances

Source: Researcher's field survey (2015)

5.3.7.4 Improved value for money

Figure 5.21, show that 50% of the respondents strongly agree and 50% agree that an effective CMS will result in improved value for money.

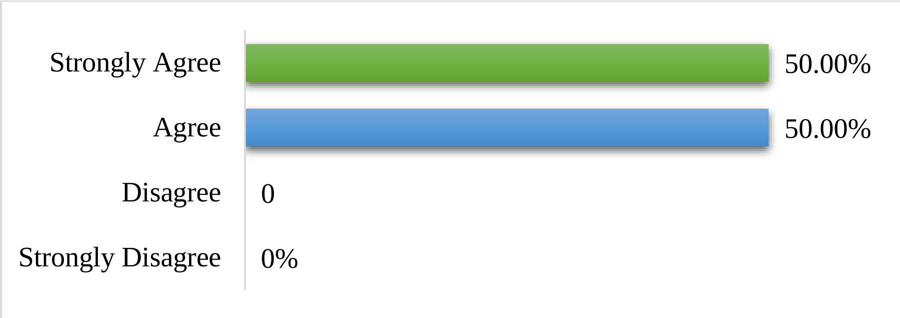


Figure 5. 21: Improved Value for money

Source: Researcher's field survey (2015)

5.3.7.5 Effective cost feedback for future projects

Figure 5.22 reveals the result of the analysis of respondent's responses. Results show 40.3% strongly agrees, 41.7% indicated agreement that an effective CMS will lead to effective cost feedback for future projects. However, 18.1% of the respondents disagree to this statement.

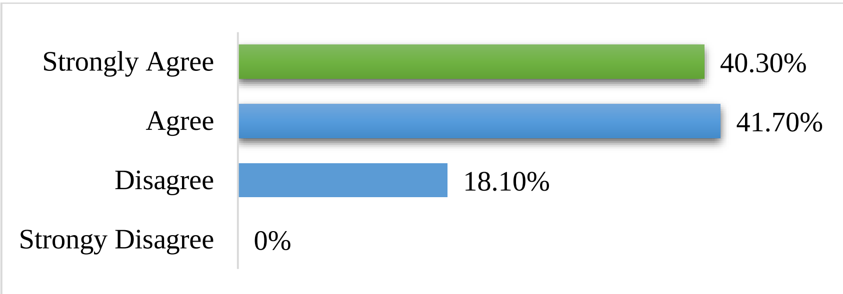


Figure 5. 22: Effective cost feedback for future projects

Source: Researcher's field survey (2015)

5.4 IMPLEMENTATION SUCCESS FACTORS

This theme investigate the drivers for CMS implementation as identified from interview findings by ranking their level of influence. Ineffective CMS influences poor cost performances of LcH projects. The responses were initially analysed using the RII score across the responding groups. After that, the Kruskal-Wallis test was used to identify any significant difference in the perspective of respondents representing the views of HAST, CST, and CNT. Following the results of the Kruskal-Wallis, the influential drivers are subject to further analysis using the factor analysis (FA). The FA examines the relationships between the drivers for grouping purposes. This section is structured as follows;

- Reliability of constructs
- Identify important drivers
- Examining relationships among drivers for the purpose of grouping into success factors

5.4.1 Reliability of Constructs

Reliability of constructs is determined by measuring the internal consistency of the data collected and Table 5.4 below shows the reliability statistics. The internal consistency of respondents on the 13 drivers are measured. The results reflected a Cronbach alpha of 0.776 showing consistency between the answers on 13 items. This result reflects the reliability of the construct is considered acceptable.

Table 5. 4: Reliability Statistics for success drivers

Questions	Cronbach's Alpha	N of Items
Drivers	**0.77**	**13**

Source: Researcher's field survey (2015)

5.4.2 Drivers for Maintaining Effective and Viable Implementation in the CMS

Table 5.5 shows the RII ranking of drivers contextual for effectively maintaining viable implementation within the CMS. To interpret the results of the RII any score 1-0.80 is rated very strong influence, 0.799-0.6 is rated strong influence, and any score less than 0.599- is considered not influential for maintaining successful and viable implementation in the CMS and cannot be subject to further analysis. It is seen that all the drivers identified contextual for CMS implementation from the qualitative phase were also confirmed in the quantitative phase. The drivers with RII >0.60 were considered influential while those that yielded RII <than 0.6

are to be considered not influential. Based on the results of the RII, all the identified drivers are influential none was below 0.6.

Table 5. 5: Ranking of identified drivers

S/N	Drivers	N	RII	Rank
1	Competent design team professionals	144	0.943	1
2	Effective team collaboration and commitment	144	0.933	2
3	Detailed Project designs and specifications	144	0.905	3
4	Clearly and well-developed client project brief	144	0.900	4
5	Effective project planning and site Supervision	144	0.883	5
6	Availability of cost data	144	0.858	6
7	Competent contractor team	144	0.843	7
8	Adequate and effective cash flow	144	0.710	8
9	Early contractor involvement	144	0.708	9
10	Stable Economic environment	144	0.703	10
11	Stable weather conditions	144	0.695	11
12	Adequate resolution of land compensation issues	144	0.678	12
13	Stable political environment	144	0.643	13
	Valid N (listwise)	144		

Source: Researcher's field survey (2015)

Subsequently, the Kruskal Wallis test was is next used to examine any significant difference on the perception of responding groups on the drivers. Therefore any drivers' with an assumption significance less than 0.05 show a significant difference in the perception of the responding groups. Result of the Kruskal-Wallis test in Table 5.6 show that none of the drivers obtained an Asymp. Sig. > 0.05. This indicates that the perception of all the respondents from the different groups has no significant difference. Therefore, all the identified drivers are contextual to CMS implementation for LcH project delivery. These drivers are subjected to further analysis using the FA.

Table 5. 6: Kruskal-Wallis test

Drivers	Chi-Square	Df	Asymp. Sig.
Clearly and well developed client project brief	0.46	2	0.79
Effective and adequate Cash flow	2.52	2	0.28
Availability of cost data	0.25	2	0.88
Detailed Project designs and specifications	0.66	2	0.72
Effective project planning and Supervision	0.59	2	0.75
Competent design team	0.50	2	0.78
Competent of contractors site management team	0.62	2	0.73
Early contractor involvement	3.32	2	0.19
Effective Collaboration of the project management team	1.20	2	0.55
Stable weather conditions	2.70	2	0.26
Stable Political environment	3.01	2	0.22
Stable Economic environment	1.49	2	0.47
Adequate land compensation to communities	0.93	2	0.63

Source: Researcher's field survey (2015)

5.4.3 Examining Relationships of Drivers Using Factor Analysis

The statistical analysis to examine the relationships is the factor analysis technique (FA). In this study, the factor analysis is used to examine relationships between the drivers and to group them into factors. The 13 drivers were subjected to FA using the principal component analysis. Before the test, the researcher ascertains the suitability of employing FA using the indicators identified in past studies (Kumar 2015; Osborne & Costello, 2009; Rattray & Jones, 2007). These include the measure of sampling adequacy Kaiser-Meyer-Olkin (KMO)-test value greater than 0.5 that shows the suitability of the sample size and the pre-analysis check of a minimum number of 100 participants and minimum participant to variable ratio, N/p: 2:1–10:1. Furthermore, Osborne and Costello (2009) illustrated through their study that 13 variables can be used to perform FA. In this research context, the SPSS results show a KMO of 0.785 and variable ratio of 11: 1 (144 participants to 13 variables). These results indicate the suitability of employing FA in this research context.

The Bartlett's Test of Sphericity affirming validity and suitability of the responses collected was less than 0.05 supporting the factorability of the correlation matrix. All factor loadings were greater than 0.5 with nine drivers above 0.7. The PCA revealed four factors with Eigenvalues exceeding 1.000 explaining 35.65%, 16.57%, 10.19 % and 7.796% of the variance. However, the scree plot (Figure 5.23) revealed a break after the third factor. Adopting the Castell (1996) scree test, three components were retained. The three-group factor solution explained 66.88% of the variance with group factor 1, 2 and 3 explaining the 38.08%, 17.87%, and 10.92 %.

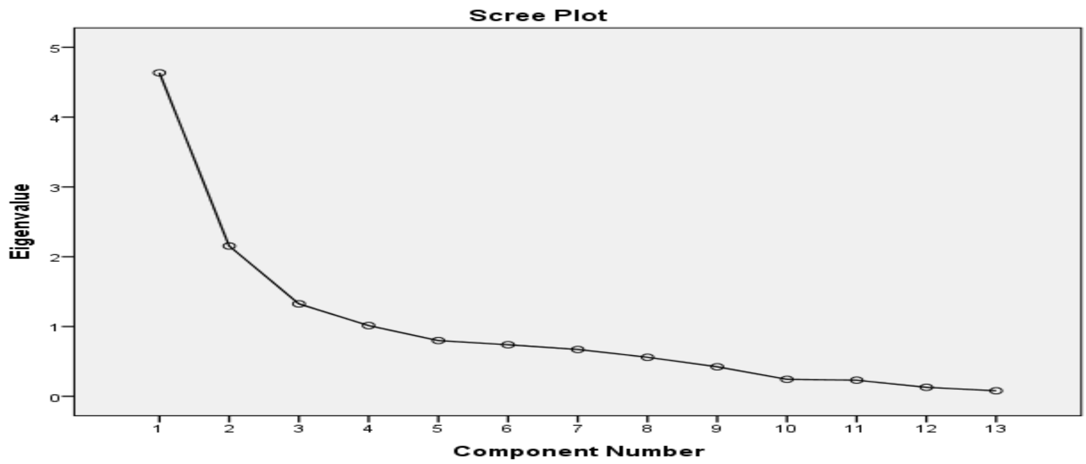


Figure 5. 23: Scree plot

Source: Researcher's field survey (2015)

The Varimax rotation was performed twice to rotate and represent correlated items with a smaller set of 'derived' groups of factors and aid interpretation. Following these steps, the analyses resulted in extracting availability of cost data variable leaving 12 items with coefficients more than 0.5 and defining three groups of factors with at least three success variables (Table 5.7). Table 5.7, show that adequate cash flow, stable economic environment, stable weather conditions, stable political environment and adequate resolution of land compensation issues loaded into the Factor 1. Adequate and detailed project designs and specifications, clear and well-developed client project brief, effective project planning and site supervision were loaded on Factor 2. While, competent design team professionals, competent contractor site team, early contractor involvement, effective team collaboration and commitment loaded on Factor 3. Given the characteristics of their drivers' Factor, 1 is termed stable operational environment, Factor 2 information, and management action and Factor 3 effective team quality. Figure 5.24 depicts this information for better clarity.

Table 5. 7: Rotated Component Matrix

Drivers	**Factor**		
	1	**2**	**3**
Adequate and effective cash flow	**.924**	-.121	.117
Stable Economic Environment	**.910**		.113
Stable weather conditions	**.906**	-.132	.105
Stable Political Environment	**.844**		
Adequate resolution of land compensation issues	**.754**	-.129	
Detailed Project designs and specifications	-.232	**.813**	.283
Clearly defined and well developed client brief	-.228	**.791**	.108
Effective project planning and Supervision	.118	**.698**	-.153
Competent design team professionals	-.210	.143	**.713**
Competent contractors site team	.287	-.191	**.711**
Effective team collaboration and commitment	.139		**.640**
Early contractor Involvement	.473	.175	**.504**

Note: The bold values represent high correlations above 0.5.

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. a. Rotation converged in 5 iterations.

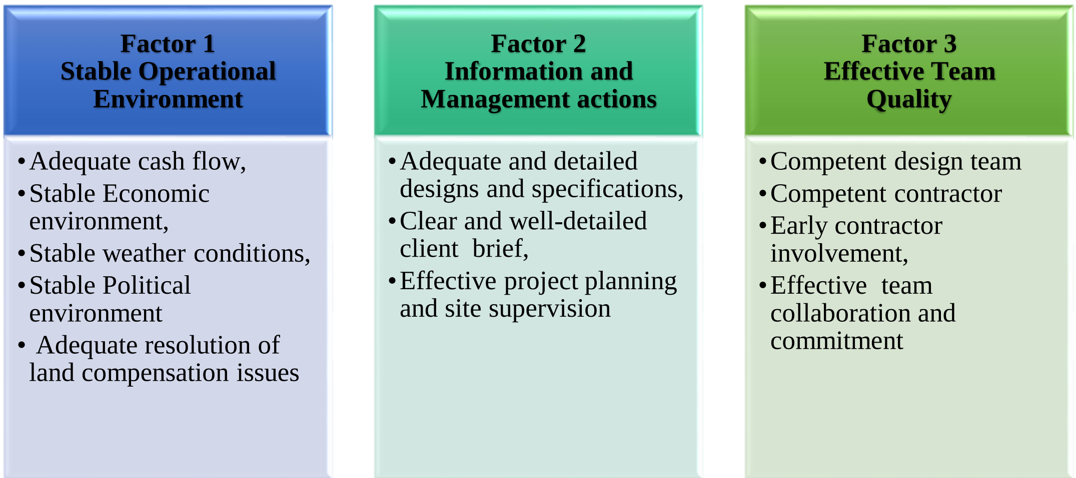


Figure 5. 24: Success Factors

Source: Researcher's field survey (2015)

However, the relationship and commonality between the drivers and the factors require further investigation.

5.5 CMS CONSTRAINTS AND IMPROVEMENT MEASURES

5.5.1 Reliability of Constructs

Reliability of constructs is determined by measuring the internal consistency of the data collected and the results are shown in Table 5.8. The results reflected a Cronbach alpha of 0.788 showing consistency between the answers on 26 items. This result reflects the reliability of the construct is considered acceptable.

Table 5. 8: Reliability analysis for CMS constraints and improvement measures

Questions	Cronbach's Alpha	N of Items
Constraints	**0.788**	**26**

Source: Researcher's field survey (2015)

5.5.2 Constraints

Difficulty to effectively set and plan project cost within client target budget, monitor real time project cost performances and poor cost control from variations were the main constraints identified.

5.5.2.1 Difficulty to monitor real time project performances

This question seeks to affirm the qualitative finding that the CMS used has difficulty in real time cost monitoring during construction. The result of this question is as shown in Figure 5.25, which reveals that 48.6 % strongly agree, 38.20% agree while 13.2 % disagree that the CMS used has difficulty in real time cost monitoring during construction.

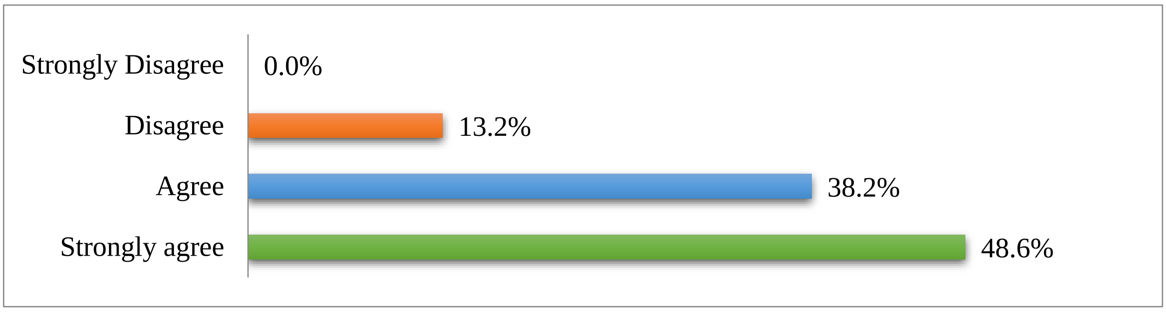


Figure 5. 25: Difficulty in monitoring real time project performances

Source: Researcher’s field survey (2015)

5.5.2.2 Difficulty to effectively set and plan project cost within client target budget

This question seeks to confirm the qualitative finding that the CMS used has difficulty to effectively plan and control project cost within target budget. The result on this question is as shown in Figure 5.26 which reveals that 38.9 %% strongly agree, 50.7% agree; while 10.4 % disagree on this finding.

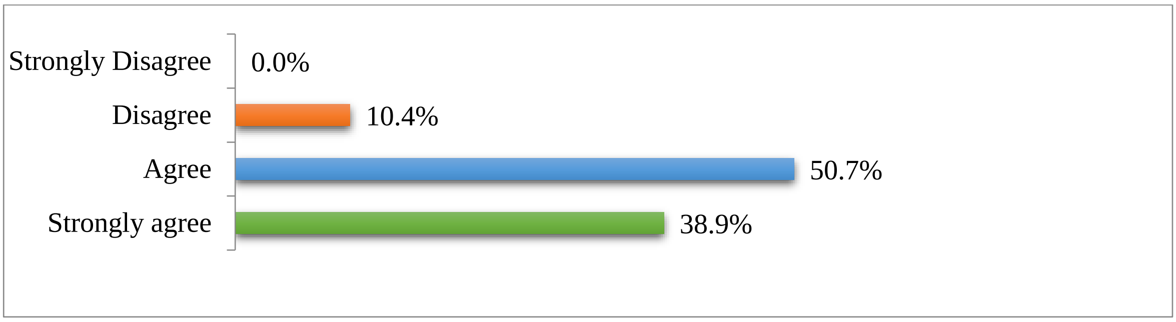


Figure 5. 26: Difficulty to effectively plan and control of project cost

Source: Researcher's field survey (2015)

5.5.2.3 Poor cost Control for variations

This question seeks to confirm the qualitative finding that the CMS used gives ample room for variations affecting project cost management and performances. According to the results as shown in Figure 5.27, 39.6 % strongly agrees, 48.6% agree, while 11.8 % disagrees on this finding.

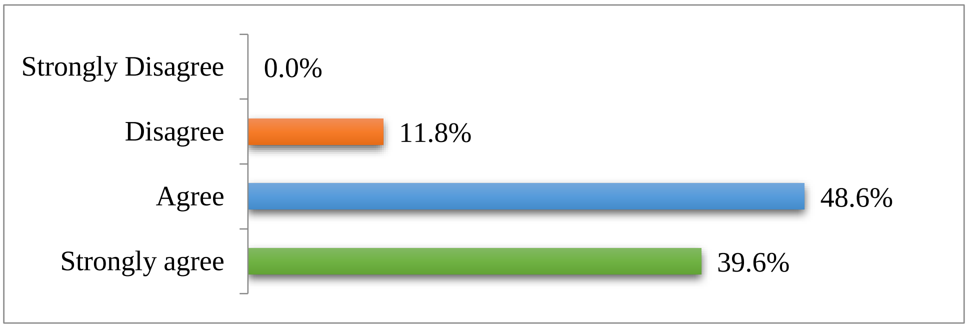


Figure 5. 27: Variations affecting cost control

Source: Researcher's field survey (2015)

5.5.2.4 Current techniques used are not sufficient

Regarding the question of the sufficiency of current techniques use, Figure 5.28 show that 55.6 % of the respondent strongly agree; while 44.4% agree that the current techniques used are not sufficient.

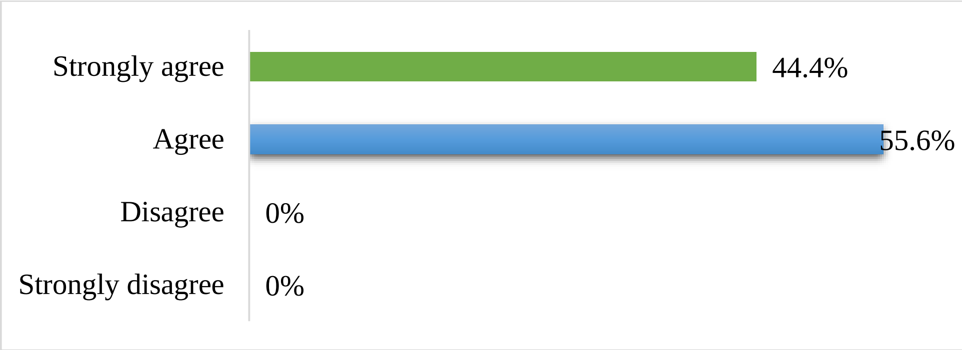


Figure 5. 28: Insufficient techniques

Source: Researcher's field survey (2015)

5.5.2.5 Implementation barriers

The 17 barriers identified from the qualitative phase were confirmed in the quantitative phase. Table 5.9 shows the RII ranking of barriers affecting CMS. All the barriers identified are specific to CMS implementation in LcH project delivery in the research context. The barriers with RII >0.60 were considered influential while those that yielded RII < than 0.6 are to be considered not influential. Based on the RII results all the identified barriers were confirmed influential as none was below 0.6.

Table 5. 9: Implementation Barriers

S/N	Barriers	N	Mean
1	Incompetent professionals	144	9.53
2	Design changes	144	9.41
3	Inadequate project planning	144	9.06
4	Poor collaboration of team members	144	9.03
5	Unclear Client Brief	144	8.89
6	Delay and inadequate funding	144	8.75
7	Government bureaucratic process affecting work approvals	144	8.72
8	Incompetent Contractor's site workers	144	8.63
9	Poor site supervision	144	8.51
10	Lack of cost data bank on previous projects	144	8.42
11	Errors in design details and estimates	144	8.39
12	Inclement Weather conditions	144	8.30
13	Inadequate Knowledge In Cost Management Competency	144	8.26
14	Ineffective communication within contractors team	144	8.13
15	Economic instability	144	8.00
16	Political instability	144	7.41
17	Burglary	144	6.88
18	Community Restiveness	144	6.62
	Valid N (listwise)	144	

Source: Researcher’s field survey (2015)

5.5.2.6 Current CMS employed need improvement to effectively deliver expected project cost performances

This question seeks to confirm the qualitative finding on the need to improve current CMS for LcH project delivery. As shown in Figure 5.29, 43.1% of the respondents strongly agree and 41.0% agree that the current CMS in use needs improvement to effectively deliver expected project cost performances. However, a minority of the respondents, 11.1%, disagree; and 4.9% strongly disagree.

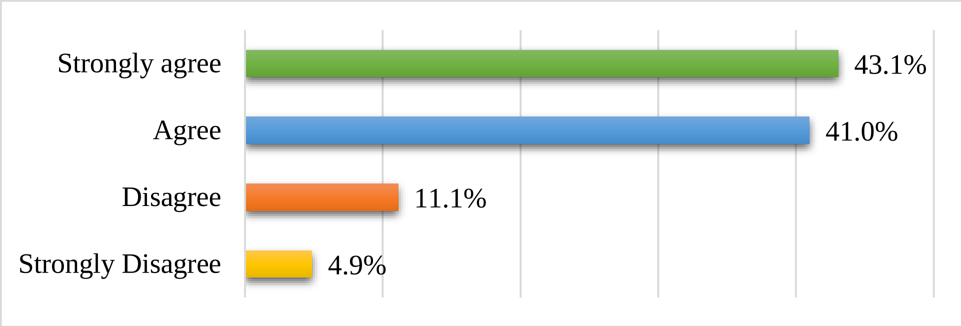


Figure 5. 29: Current CMS need improvement

Source: Researcher's field survey (2015)

5.5.3 Improvement Measures

Findings from literature review and semi-structured interviews show that the efficacy of the CMS is critical to achieve effective LcH project cost performances. Therefore, this theme in the questionnaire seeks to confirm the earlier findings of this research.

5.5.3.1 Integrating TC and EVA can aid technical improvement in the CMS.

This question seeks to affirm the views from the qualitative findings that target costing and EVA can improve the efficacy of the CMS being used. As shown in Figure 5.30, 40.3% of the respondents strongly agree and 42.4% agree that integrating Target costing and EVA techniques into the CMS will improve the system level of efficacy. However, a minority of the respondents, 15.3% disagree; while 2.1% strongly disagree.

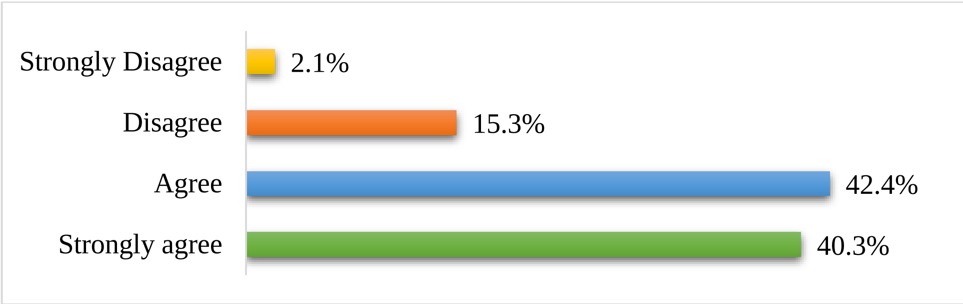


Figure 5. 30: Integrate Target costing and EVA

Source: Researcher's field survey (2015)

5.5.3.2 Cost-design-control approach can improve current CMS efficacy

This question seek to confirm that a cost-design- control approach will improve the effectiveness of the CMS. The results as shown in Figure 5.31, reveal that 58% of the respondents strong agree that this approach can improve CMS efficacy while 42% agree. There was no disagreement by the respondents on this matter.

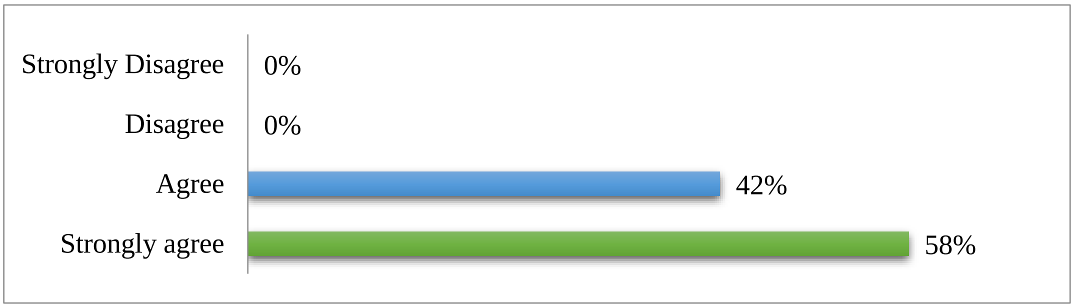


Figure 5. 31: Cost-design-control approach

Source: Researcher's field survey (2015)

5.5.3.3 Conditions necessary for effective CMS implementation

This question seeks to affirm the need for integrating the identified drivers for improved CMS implementation. As shown in Figure 5.32, 52.1% of the respondents strongly agree and 38.9%

agree that the drivers will aid effective implementation in the CMS. However, 9.0% representing a minority of the respondents disagree.

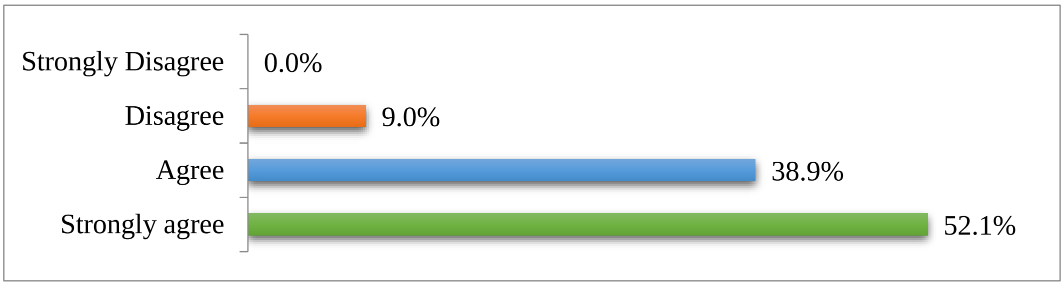


Figure 5. 32: Drivers for effective CMS implementation

Source: Researcher's field survey (2015)

5.5.3.4 A Comprehensive CMS Model can assist PMT in Effective Cost Management

Regarding this theme, Figure 5.33 indicates that 53.5% of the respondents strongly agree; while 40.3% agree that there is a need for comprehensive CMS model that can assist the PMT in the effective cost management and performances of the LcH projects in the Nigerian southeast zone. However, 6.3% of the respondents disagree on this need.

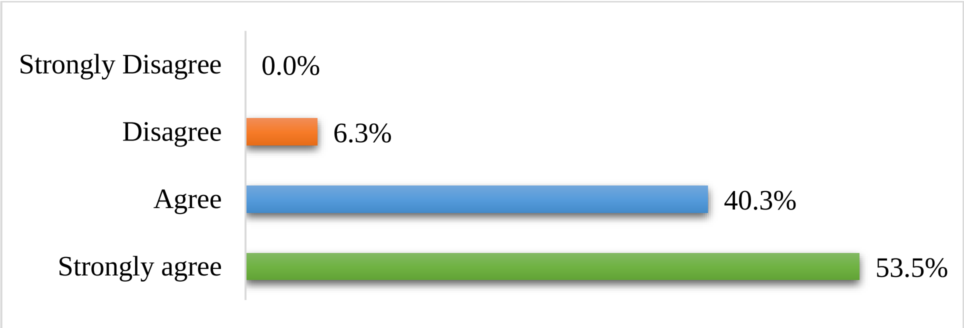


Figure 5. 33: Need for a comprehensive CMS model

Source: Researcher's field survey (2015)

5.6 QUANTITATIVE FINDINGS FROM THE CASE STUDY

The following findings were drawn from the quantitative data analysis and results on the themes: LcH project delivery, project cost management system, and implementation success factors.

- Findings confirms the five key benefits of effective CMS from the qualitative findings of the case study. These five benefits include effective cost management, effective cost performance; improved value for money, improved client satisfaction, effective cost feedback for future projects.
- Cost estimating, onsite resource control, cash flow analysis, cost reporting, and site meetings are popular techniques used in CMS for LcH project delivery in the Nigerian southeast zone. Target costing and EVA techniques were rarely used.
- The Design-cost-control is more popular process approach adopted in the CMS for LcH project delivery in the zone.
- The CMS in use has a high significant influence on the poor cost performances of LcH projects experienced in the zone.
- The current systems for LcH project delivery are deficient in real time cost monitoring, effective planning and project cost control and give room for much variations affecting effective cost control. These deficiencies contribute to the system incapability to deliver effective cost management and performances.
- The deficiency of the CMS in current use are traceable to both technical and implementational areas. These include the inappropriate choice of techniques, process approach and the presence of 17 implementation barriers.
- Three key IMSF: effective team quality, stable operational environment, and effective information and management were confirmed influential to maintain effective and viable implementation of the techniques and processes within the CMS.
- To improve the efficacy of the CMS for LcH project delivery findings confirms the need to adopt Target costing and EVA, cost-design-control approach and 3 key IMSF.
- Finally, a model depicting an improved CMS is necessary to assist the PMT achieve effective cost management and performances on LcH project delivery in the Nigerian southeast zone.

5.7 SUMMARY OF THE CASE STUDY FINDINGS

As observed the findings of the quantitative data analysis and results in this chapter explains and confirms most of the findings from the qualitative data analysis on CMS characteristics and efficacy on poor cost performances, IMSF and measures to improve current CMS for LcH project delivery in the zone. Both qualitative and quantitative findings of the case study confirm the contextual characteristics of the CMS employed for LcH project delivery in the zone. The key findings from the case study are summarized below:

- Out of the ten techniques identified from the qualitative findings, five techniques are confirmed popularly employed in the CMS for LcH project delivery in the zone. Target costing and EVA techniques though highlighted in the qualitative findings, the quantitative findings confirmed they were rarely used. The case study finding clearly indicates that conventional CMS techniques are popularly used.
- Two primary process approaches were highlighted from the qualitative findings: Cost-design-control and design-cost-control adopted in the CMS for LcH project delivery. However, the quantitative findings confirm design-set-control approach is popularly in use. The case study findings clearly indicate that the process approach is a reactive management approach.
- The case study results (qualitative and quantitative) confirm that the CMS in use has a high significant influence on the poor cost performances of LcH projects experienced in the zone.
- Both qualitative and quantitative findings of the case study confirm that the current systems are deficient in real time cost monitoring, effective planning and project cost control and give room for much variations affecting effective cost control.
- The deficiency of the CMS in current use is traceable to both technical and implementational areas. These include the inappropriate choice of techniques, process approach and the presence of 17 implementation barriers. This finding clear indicates that the system is not capable of delivering effective cost management and performances. Hence, need viable improvement in both technical, process and control parameters of the CMS.

- 13 drivers were identified influential to maintain the effective and viable implementation of the techniques and processes within the CMS from the qualitative findings. 12 of these drivers were rotated into three key IMSF: effective team quality, stable operational environment, and effective information and management actions. These IMSF were confirmed influential to improve CMS efficacy for LcH project delivery.
- The case study findings (qualitative and quantitative) confirm that to improve the efficacy of current CMS for LcH project delivery the following are highlighted expedient. Adoption of modern cost management techniques (TC and EVA), a proactive process approach (cost-design- control) and consideration of the three key IMSF.
- Case study findings confirm five key benefits that can be gained by employing an improved and effective CMS in LcH project delivery in the zone.
- Finally, a model depicting an improved CMS is necessary to assist the PMT to achieve effective cost management and performances on LcH project delivery in the Nigerian southeast zone.

The CMS improvement measures highlighted from the findings of the case study are therefore integrated into the development of the CMSM presented in chapter six of this report.

5.8 CHAPTER SUMMARY

This chapter presented the quantitative analysis and findings of the research. The questionnaires were directed specifically to investigate further and confirm qualitative findings relating to the areas of project cost performance, the LcH project cost management system, and IMSF. It detailed the key results that emerged from the respondents who are involved in the cost management practice in the LcH project delivery in the Nigerian southeast zone. Results confirm that the CMS employed across LcH projects have constraints that affect performance outcomes. Furthermore, integrating modern techniques and considerations of IMSF can improve the efficacy of CMS in current use. Finally, a comprehensive CMS model is identified as crucial for standardised cost management practice. Also, it can assist the PMT to achieve implement and achieve effective cost management and cost performances in LcH project delivery. Finally, the findings from this chapter clearly identify the components needed to develop the CMSM that will assist the PMT to achieve effective LcH project cost management and performance in the Nigerian southeast zone in the near and far future. The next chapter presents and discusses the CMSM model development and validation

CHAPTER SIX

CONCEPTUAL MODEL DEVELOPMENT AND VALIDATION

6.1 INTRODUCTION

Chapter 5 discussed the analysis and the findings of the quantitative data from the case study. This chapter moves forward to conceptualise the CMS model that can assist the PMT in effective cost management and performances of LcH project delivery in both the Southeast zone and Nigeria. The conceptual cost management system model (CMSM) developed to present a representative structure consisting of appropriate set of techniques, process approach and IMSF of an effective CMS that can deliver expected management outcomes. The CMSM reflects the various stages of project delivery for easier interpretation, understanding and use by the PMT. The chapter is structured as follows:

- Aim of the CMSM
- CMSM components description
- CMSM design and development
- CMSM validation
- CMSM operational guide

6.2. A CONCEPTUAL MODEL- AN OVERVIEW

A model is a representation of a designed or actual object, process or system representation of reality (Fellows & Liu, 2015). Earp and Ennett (1991) defined a model as a conceptual framework for organising and integrating information or a theoretical structure, which refers to the visual representation of a theory. A model is a representation or abstraction of an actual object or situation showing the interrelationships of an action and reaction regarding a cause and effect (Easterby-Smith et al., 2008). It seeks to highlight relationships within variables and enable the formulation of testable related propositions. Therefore, a model must be a representative of those aspects of a structure in reality that is being investigated and should clearly show the relationships between the variables in context.

According to Fellows and Liu (2015), models come in various forms to serve various purposes. They highlight different types of models such as architectural models, economic and econometric models, and Treasury models. The authors elaborated that the common forms of models in construction research are categorised into graphical and mathematical models. Graphical models are visual and logical, used to illustrate directional relationships amongst constructs; while the mathematical models explicitly specify relationships amongst variables in a mathematical form (Fellows & Liu, 2015). A conceptual model is one of such graphical models that help to structure the researcher's ideas about the relationships amongst various concepts and variables in a system (Sekaran & Bougie, 2013). It helps users to know and understand a system the model represents. It is a schematic diagram to enable visual relationships amongst theorized concepts, and thus, giving a quick idea of how an issue can be easily solved. It also seeks to highlight relationships within variables and enables the formulation of testable related propositions. Therefore, the primary objective of a conceptual model is to convey the fundamental principles and basic functionality of the system it represents in such a way as to be easily understood by the model users. According to Bernard and Ryan (2010) and Marshall and Rossman (1999) reiterated that conceptual models could be statistical models; process models; decision models or transition models. However, the choice of the model type is dependent on the researcher and study context.

Conceptual model development should satisfy four fundamental objectives (Kung & Solvberg, 1986):

- Enhance an individual's understanding of the representative system
- Facilitate efficient conveyance of system details between stakeholders
- Provide a point of reference for system designers to extract system specifications
- Document the system for future reference and provide a means for collaboration

Developing the model requires a systematic process. Bernard and Ryan (2010) suggested the consideration of three critical steps that include:

- Identification of key constructs to be included in the model
- Identification of the relationships between these key constructs and a representation of these relationships

- Validation of these relationships to ensure that the system correctly represents the piece of reality under consideration and the user's requirements

In a more detailed procedure, Mihram (1972 in Fellows & Liu, 2015) documented the following steps as illustrated in Figure 6.1.

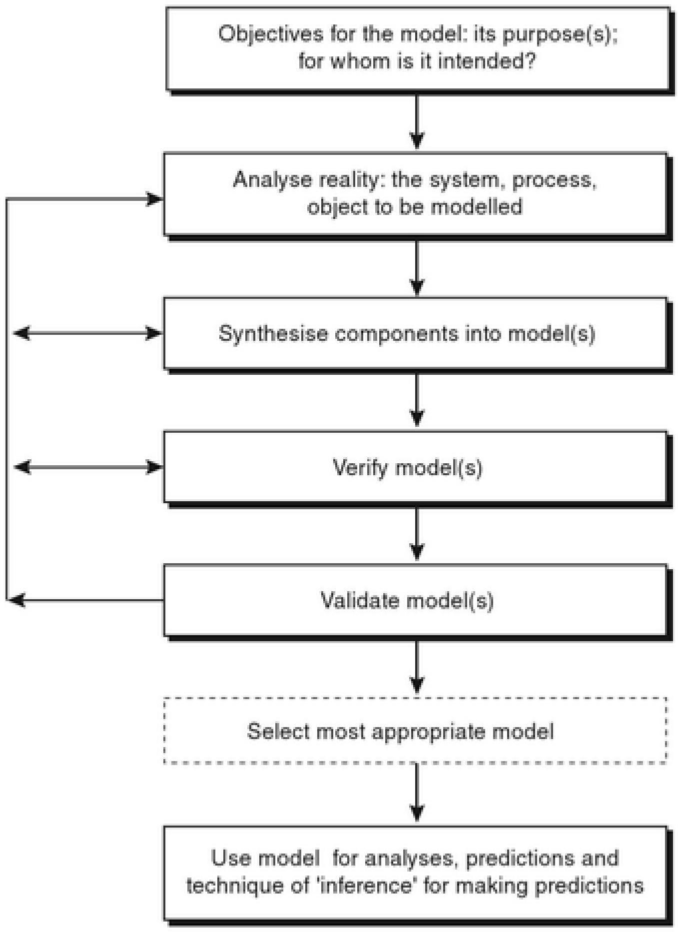


Figure 6. 1: Model development process

Source: Mihram (1972in Fellows and Liu 2015)

Given the identification of variables that could be related to each other in a system, contextual relationships both direct and indirect need to be mapped to effectively develop this conceptual model. Therefore, drawing from the espoused views by Bernard and Ryan (2010) and Mihram (1972 cited in Fellows& Liu, 2015), the model development methodology adopted in this research is illustrated in Figure 6.2.

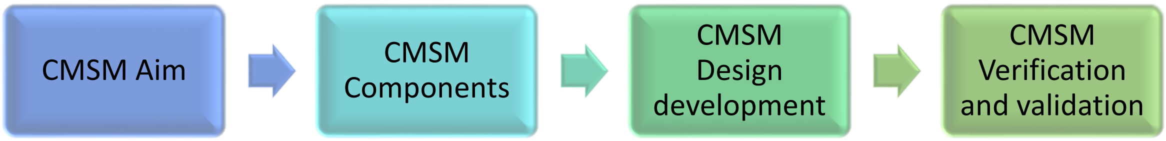


Figure 6. 2: CMSM development process

6.3 AIM OF THE CMSM

The motivation guiding the development of conceptual models could be to describe how a system presently works, or prescribe how a system should work (Browning et al., 2006). It can also be both descriptive and prescriptive. The aim of developing the CMSM is prescribe how an effective system should work. This model can assist the PMT attain effective project cost management in the delivery of the LcH projects in the Nigerian southeast zone. The findings thus far have diagnosed the constraints of current CMS in use, and the CMSM attempts to propose improvement measures in a model. The contents of the proposed CMSM helps the PMT to identify the potential techniques, process approach and respective IMSFs for effective cost management practice at the predesign, design, and construction stages of LcH projects towards effective performances system outcomes.

6.4 CMSM COMPONENTS

Yin, (2009) and Eisenhard (1989) maintained that in building a theory, it is important to have a predefined research question, or conceptualised the phenomenon before data collection and analysis to avoid the researcher from being overwhelmed by a large amount of data gathered. This statement corroborates earlier views by Eisenhard (1989) which stated that case study research begins with a deductive approach and moves on to an inductive approach to build a theory. Therefore, the key findings from the literature, the semi-structured interviews, and questionnaire survey are all input to develop the CMSM. The main components of the CMSM are further discussed.

6.4.1 Benefits

Several benefits of an effective CMS have been discussed in the extant literature and from the case study findings of this research. Findings of the literature reveal 13 commonly cited benefits of employing an effective CMS (Section 2.7.1) and five of these identified benefits were validated in the context investigated by participants and respondents (Section 4.7 and 5.3.3) as documented in Figure 6.3. These five benefits are therefore considered important to develop the CMSM.

Literature review

- Cost/ time reduction
- Process and product improvement
- Forecast and control of resources
- Value for money
- Balanced distribution of expenditure
- Competitive advantage
- Budget finance evaluation
- Improved decision making
- Cost performance
- Customer satisfaction
- Quality control
- Information generated to support design and construction process
- Increased cost transparency

Semi Structured interviews

- Improved value for money,
- Effective LcH project cost performances,
- Effective cost feedback for future projects,
- Improved client satisfaction
- Improved project cost management

Questionnaires

- Effective cost management
- Improved value for money
- Improved client satisfaction
- Effective cost performances
- Effective cost feedback for future projects

Figure 6. 3: Findings on benefits of effective CMS

6.4.2 Cost Management Techniques

In retrospect, findings from the literature review identified 11 commonly cited cost management techniques (section 2.7.3). Findings from the participants eight of these techniques were contextual to LcH project cost management (Section 4.4.1 and 5.3.5). Site meetings emerged as a cost management technique in use. Respondents ranked five popular techniques in use and recommended the integration of two additional modern techniques to improve the

CMS for LcH project delivery (Figure 6.4). Therefore, seven techniques are identified relevant. These seven techniques are therefore considered important to develop the CMSM.

Literature review findings	Semi-structured interviews findings	Questionnaires findings
• **common techniques in use** • cost planning, • cost estimating and budgeting, • cash flow forecasting, cost reporting, • onsite project resource control, • value engineering, • Target value design/Target costing, • kaizen costing, • activity based costing Earned value analysis	• **Contextualised techniques in use** • site meeting • cost planning, • cost estimating • Cost budgeting, • cash flow forecasting, • cost reporting, • onsite project resource control, • Target costing, • Earned value analysis	• **Predominat techniques in use** • Site meeting • cost estimating • cash flow forecasting, • cost reporting, • onsite project resource control • **Recommendation** • Target costing • Earn value analysis

Figure 6. 4: Findings on cost management techniques

6.4.3 Cost Management Process

Literature findings highlighted four main process stages: setting, planning and estimating, budgeting, monitoring and control. These stages are employed using two process approaches cost-design-control and design-cost-control. Findings from the semi-structured interviews and questionnaires confirmed the use of two approaches in use. However, the design-cost-control approach is more popularly employed in the CMS for LcH project delivery and suggestions for improvements recommends the adoption of the cost-design-control approach (Figure 6.5). Therefore, the cost-design-control process approach is considered important in developing the CMSM.

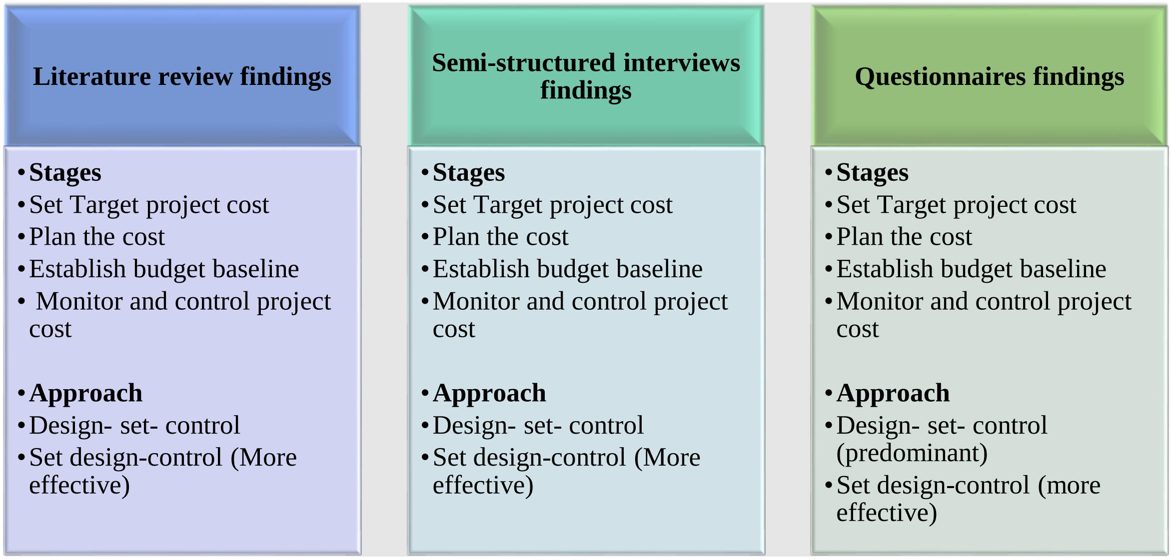


Figure 6. 5: Findings on CMS process

6.4.4 Implementation Success Factors

Literature findings identified 13 drivers associated with the team, management, and external factors. Findings from semi-structured interviews highlighted 13 drivers 12 of these drivers based on the FA rotated into three IMSF. The three IMSF include effective team quality, stable operational environment, and effective information and management actions. (Figure 6.6). The three IMSF are considered relevant for improved CMS implementation and are therefore considered important to develop the CMSM.

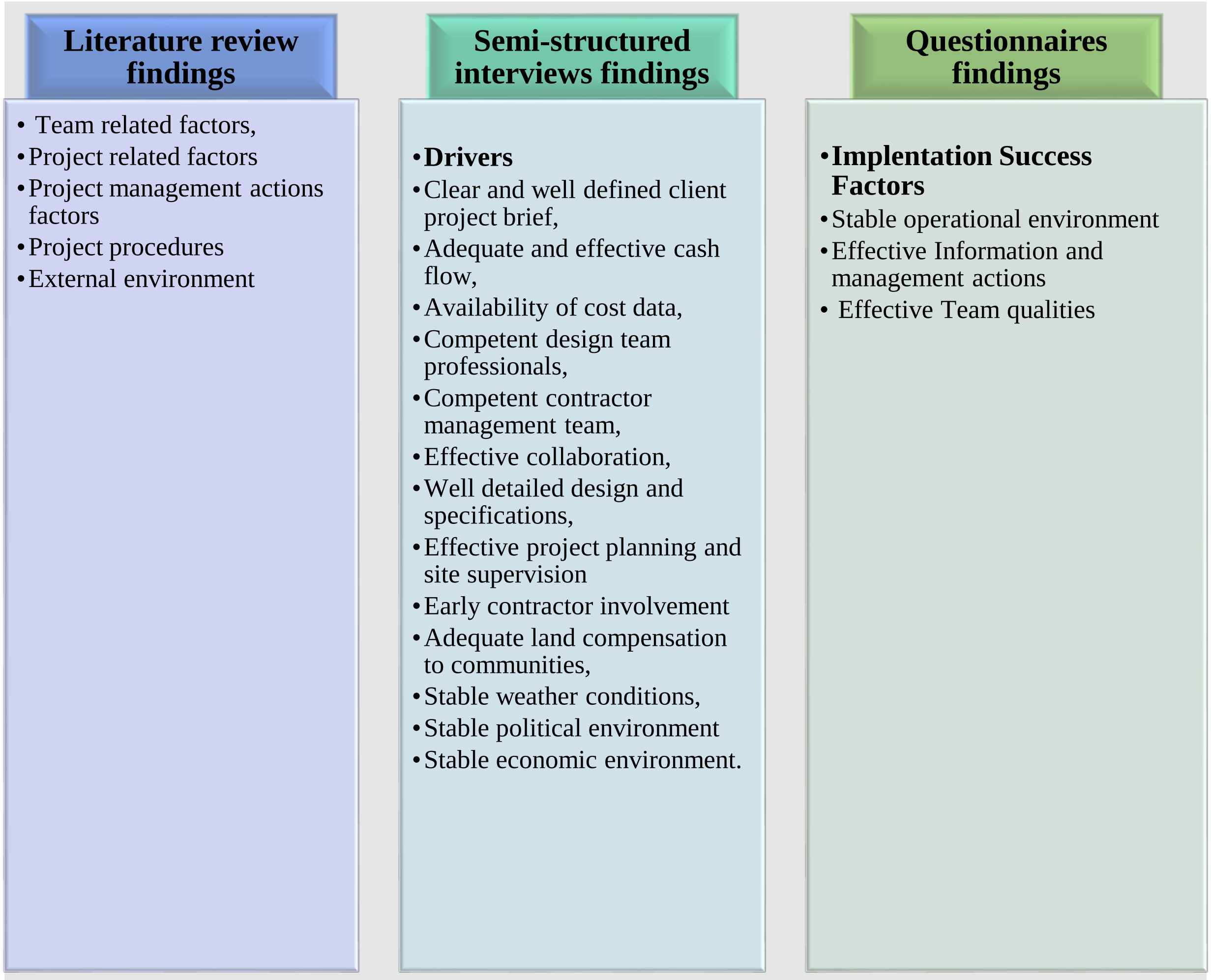


Figure 6. 6: Findings on implementation success factors and their drivers

6.5 CMSM DESIGN METHODOLOGY

A conceptual model needs to establish the relationships between the variables and relate the cause and effect of the variables on the system outcomes (Tsehayae & Fayek, 2016). Therefore, to design the CMSM, there is a need for a careful choice of the appropriate modelling approach to establishing proper relationships within the system. The process modelling approach, IRP, and ISM techniques have been adopted for this purpose.

6.5.1 Process Modelling Approach

The process model is one of the many approaches used in the field of construction literature used to understand and explore the means of modelling a system to simplify a complex system in a real life situation to solving a management problem highlighting the input process and outcome variables (Tsehayae &Fayek, 2016; Karhu, 2003). Over the years, process modeling has been used by several researchers (Sanvido, 1988; Kagioglou et al., 1998; Windapo, 2013; Tsehayae & Fayek, 2016) in the construction literature have designed systems for improving construction projects process and management using a process model. One of the most referenced process models in construction research is that developed by Sanvido et al. (1988) for assisting the provision of a construction facility, which structures a problem-solving methodology that addresses issues relating to planning and control of construction projects. Examples of process models developed by Windapo (2013) and Sanvido (1988) are illustrated in Figure 6.7 and 6.8.

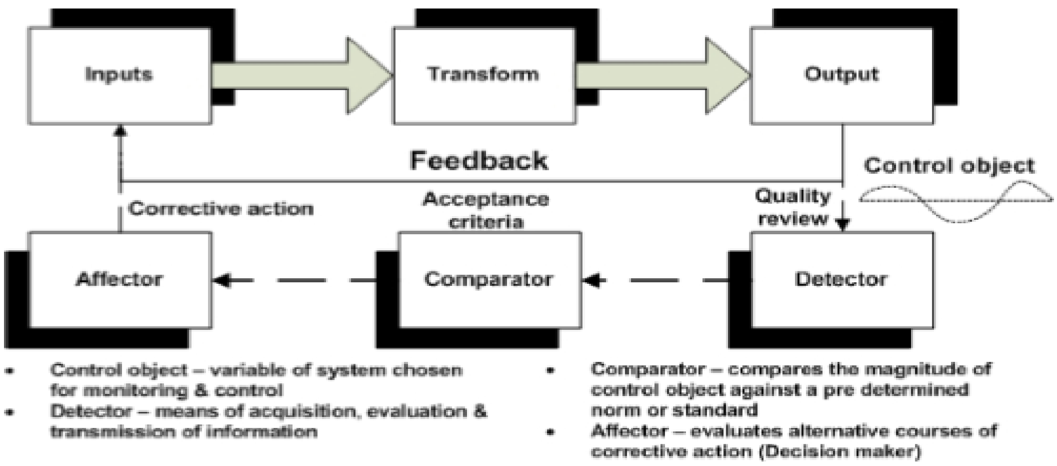


Figure 6. 7: Process model of a construction management system

Source Windapo, (2013)

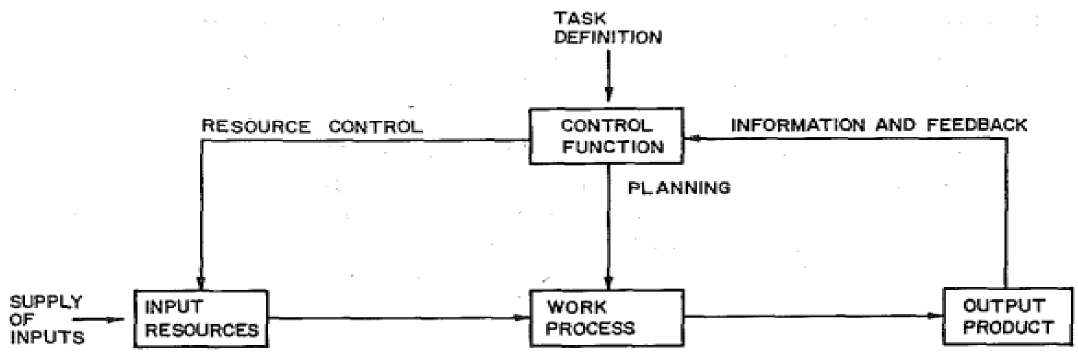


Figure 6. 8 Dynamic process system model

Source: Sanvido (1988)

In this study context, the conventional input-process-output (IPO) model approach is adopted for simplicity and clearer understanding by the PMT. The various contents of the subsystem in the CMSM are highlighted.

- *Input subsystem*: This subsystem embodies the techniques that are implemented in the cost management process. It refers to as the independent subsystem in the system.
- *Process subsystem:* This subsystem incorporates the implementation process where the techniques are employed at various stages in consensus with the project delivery stages (pre-design, design, and construction stages) to attain the desired outputs of the system. It is viewed as the mediating or transformation subsystem.
- *Control subsystem:* This subsystem embodies the success factors needed to moderate the input and process subsystems and to provide feedback within the system.
- *Outcome subsystem*: This subsystem ensures that outputs of the implementation process support the desired output of the performance objective and finally the project success. This subsystem could be viewed as a dependent subsystem.

Following findings from the literature, the effective cost performance and management are a product of the appropriate implementation of the techniques and process in the CMS. Furthermore, ensuring effective implementation is subject to the proper identification and consideration of key IMSF. Hence, there is a relationship between the techniques, process, and IMSF. These relationships influence the outcome from the system.

Therefore, the conventional IPO model approach is used to map the relationship between the techniques, process, IMSF and outcomes that gave rise to the first draft of the CMSM (Section 2.10). The components of the initial conceptual model evolved from literature findings and propositions of the research.

The second draft of the model as shown in Figure 6.9 evolved from the findings of the case study findings semi-structured interviews and questionnaires. The appropriate techniques, process approach and IMSF identified for effective CMS outcomes were depicted in this second model draft. However, the findings from the case study only helped achieve the identification of the IMSF and its drivers. There was need to further understand the relationship between the drivers themselves and with respect to the performance pointers of the cost management process for easier understanding and representation in the CMSM. The Interpretive Structural Modelling (ISM) and Interpretative Ranking process (IRP) techniques are used to determine the contextual relationship among the IMSF drivers and rank them with respect to each performance pointers in the cost management process.

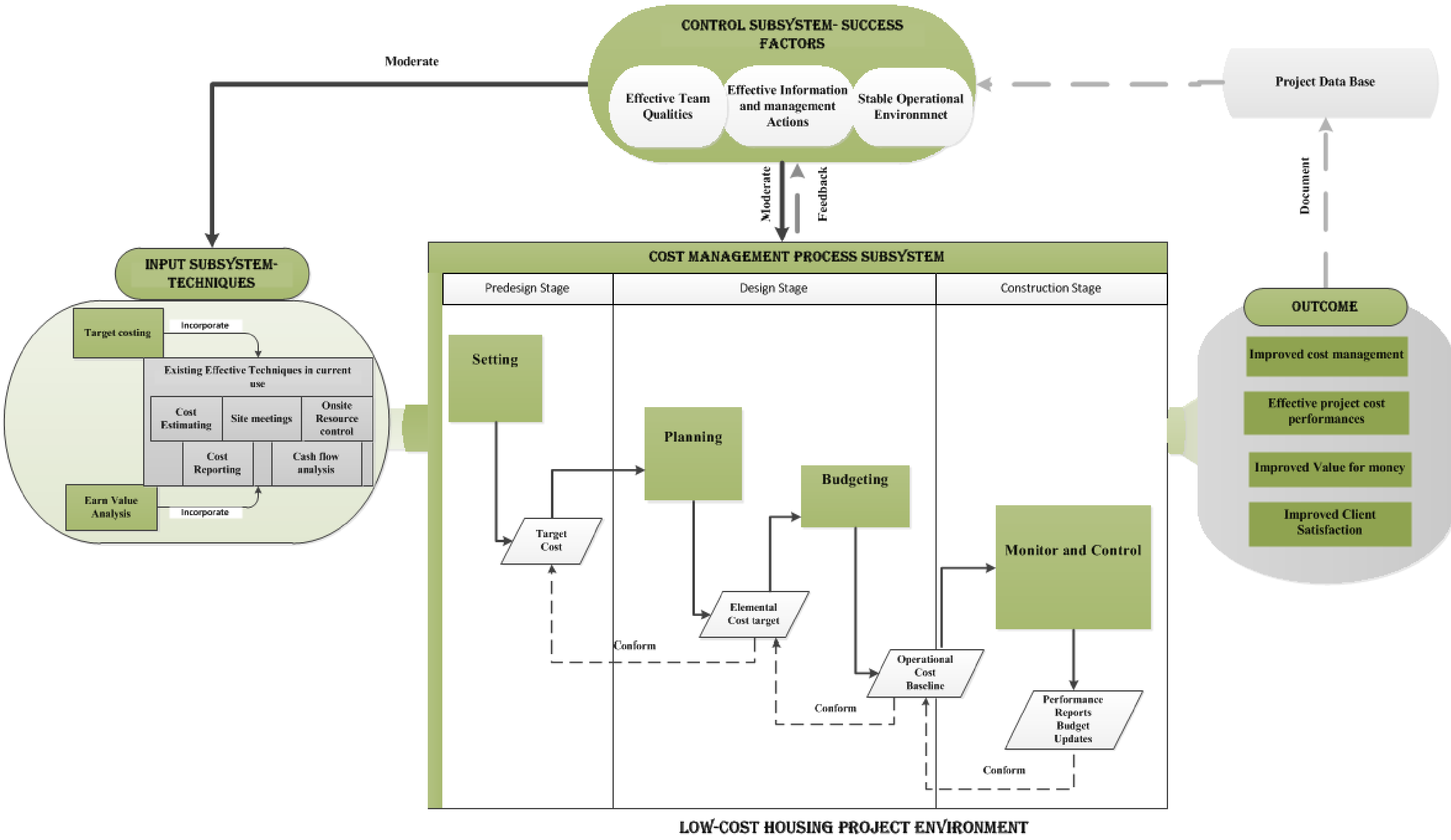


Figure 6. 9: Conceptual model second draft

6.5.2 Interpretive Structural Modelling (ISM) Methodology

The Interpretive Structural Modelling (ISM) is a technique developed by Warfield in 1974 and has since become a computer-aided method for developing graphical representations of system composition and structure (Attri et al., 2013). It is a modelling technique, in which the specific relationships and overall structure are portrayed in a digraph model (Sharma et al., 2014). It is an interpretive methodology where experts decide how different factors or variables are related which helps to impose order and direction on the complexity of relationships among the variables in a system (Sage, 1977, cited in Attri et al., 2013; Singh et al., 2003). Attri et al., (2013) espoused that the ISM helps to identify variables relevant to the investigated phenomenon and then extends with a group problem-solving technique. Some applications of ISM is found in the literature (Jyoti et al., 2010; Tripathy, 2013; Sharma et al., 2014; Khanam et al., 2015). However, none of these studies has been conducted in determining relationships of drivers associated with CMS implementation. This makes the use of ISM in this context a novel contribution. Developing the ISM involves the following steps:

- Step 1: Use expert opinion to develop the structural self-interaction matrix (SSIM) based on identified factors
- Step 2: Convert the SSIM into an initial reachability matrix
- Step 3: Develop the final reachability matrix form the initial reachability matrix
- Step 4: Level partitioning of final reachability matrix
- Step 5: Classification and categorisation of factors
- Step 6: Develop the Diagraph

6.5.2.1 Structural self-interaction matrix (SSIM)

Warfield (1974 in Sharma et al., 2014) suggested that an ideal group of experts to aid the SSIM development should be between five to ten participants. In this case, eight experts were engaged. The participants were presented with the findings of the FA and asked to identify the relationship between the drivers using the term “facilitates” to connote links. This link means that one driver facilitates the other. Their views assisted in developing the structural self-interaction matrix (SSIM). The SSIM uses four symbols to denote the direction of the relationship between any two Driver (i and j):

- V: indicates that a driver i will facilitate a driver j
- A: indicates that a driver j will be facilitated by a driver i
- X: indicates that a driver i and j will facilitate each other
- O: indicates that a driver i and j are unrelated

From the opinions of the experts' gathered through a focus group, the pair-wise relationship between the IMSF drivers using the symbols V, A, X and O is mapped in the SSIM. The initial draft of the SSIM was presented to the experts for verification after which the final the SSIM table was developed (Table 6.1).

6.5.2.2 Initial Reachability Matrix

The alphabetical values in the SSIM were converted into a binary matrix substituting V, A, X, O by 1 and 0 following these rules:

- For V in the SSIM, the (i,j) entry becomes 1 and (j, i) entry becomes 0.
- For A in the SSIM, the (i,j) entry becomes 0 and (j, i) entry becomes 1.
- For X in the SSIM, the (i,j)entry becomes 1 and (j, i) entry also becomes 1.
- For O in the SSIM, the (i,j) entry becomes 0 and (j, i) entry also becomes 0.

The results from the substitution evolved the initial Reachability Matrix presented in Table 6.2.

Table 6. 1: Structural self-interaction matrix (SSIM)

		Clear And Well Detailed Client Brief	Adequate and detailed designs and specifications	Effective project planning and supervision	Competent design team professionals	Competent contractor site team	Early Contractor involvement	Effective team collaboration and commitment	Adequate and effective Cash flow	Stable economic envoironment	Stable political environment	Stable weater conditions	Effective resolution of Land compensation issues
		D1	D2	D3	D4	D 5	D6	D7	D8	D9	D10	D11	D12
Clear And Well Detailed Client Brief	D1		V	V	A	A	A	A	V	A	A	O	O
Adequate and Detailed Designs and Specifications	D2			X	A	A	A	X	O	O	O	O	A
Effective Project Planning And Supervision	D3				A	A	A	A	X	O	O	A	A
Competent Design Team Professionals	D4					V	V	V	V	O	O	O	O
Competent Contractor Site Team	D5						V	V	V	O	O	O	O
Earily Contractor Involvement	D6							V	V	O	O	O	O
Effective Team Collaboration And Commitment	D7								V	O	O	O	V
Adequate And Effective Cash flow	D8									A	A	O	X
Stable Economic Environment	D9										X	0	V
Stable Political Environment	D10											O	V
Stable Weater Conditions	D11												O
Effective resolution of Land compensation issues	D12												

Table 6. 2: Initial reachability matrix

		Clear And Well Detailed Client Brief	Adequate and detailed designs and specifications	Effective project planning and supervision	Competent design team professionals	Competent contractor site team	Early Contractor involvement	Effective team collaboration and commitment	Adequate and effective Cash flow	Stable economic environment	Stable political environment	Stable weather conditions	Effective resolution of Land compensation issues
		D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12
Clear And Well Detailed Client Brief	D1	1	1	1	0	0	0	0	1	0	0	0	0
Adequate and Detailed Designs and Specifications	D2	0	1	1	0	0	0	1	0	0	0	0	0
Effective Project Planning And Supervision	D3	0	1	1	0	0	0	0	1	0	0	0	0
Competent Design Team Professionals	D4	1	1	1	1	1	1	1	1	0	0	0	0
Competent Contractor Site Team	D5	1	1	1	0	1	1	1	1	0	0	0	0
Early Contractor Involvement	D6	1	1	1	0	1	1	1	1	0	0	0	0
Effective Team Collaboration And Commitment	D7	1	1	1	0	1	1	1	1	0	0	0	1
Adequate And Effective Cash flow	D8	0	1	1	0	0	0	0	1	0	0	0	0
Stable Economic Environment	D9	0	0	1	0	0	0	0	1	1	1	0	1
Stable Political Environment	D10	0	0	1	0	0	0	0	1	1	1	0	1
Stable Weather Conditions	D11	0	0	1	0	0	0	0	0	0	0	1	0
Effective resolution of Land compensation issues	D12	0	1	1	0	0	0	0	0	0	0	0	1

6.5.2.3 Final reachability matrix

The final reachability matrix is obtained by incorporating a transitivity. The logic for transitivity is that if a driver i facilitates a driver j and driver j facilitates a driver k then it possible that factor driver I can facilitate driver k. This logic was employed and used to develop the final reachability matrix. Modifications were made on some values and notated as 1* (Table 6.3).

Table 6. 3: Final Reachability Matrix

Drivers		D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	Total
Clear And Well Detailed Client Brief	D1	1	1	1	0	0	0	0	1	0	0	0	0	4
Adequate and Detailed Designs and Specifications	D2	0	1	1	0	0	0	0	1*	0	0	0	0	2
Effective Project Planning And Supervision	D3	0	1	1	0	0	0	0	1	0	0	0	0	3
Competent Design Team Professionals	D4	1	1	1	1	1	1	1	1	0	0	0	1	9
Competent Contractor Site Team	D5	1	1	1	1	1	1	1	1	0	0	0	1	9
Early Contractor Involvement	D6	1	1	1	0	1	1	1	1	0	0	0	1	8
Effective Team Collaboration And Commitment	D7	1	1	1	0	0	1	1	1	0	0	0	1	7
Adequate and Effective Cash flow	D8	0	0	1	0	0	0	0	1	0	0	0	0	2
Stable Economic Environment	D9	1	0	1	0	0	0	0	1	1	1	0	1	6
Stable Political Environment	D10	1	0	1	0	0	0	0	1	1	1	0	1	6
Stable Weather Conditions	D11	0	0	1	0	0	0	0	0	0	0	1	0	2
Effective resolution of Land compensation issues	D12	0	0	1	0	0	0	0	1	0	0	0	1	3
		7	**7**	**12**	**2**	**3**	**4**	**4**	**10**	**2**	**2**	**1**	**7**	**61**

6.5.2.4 Level partitioning

Level partitioning provides a platform to develop the diagraph of the ISM model. These partitions are assigned when the reachability set (consists of the driver itself and another driver (s) that it may facilitate) and the intersect set are same (Haleem et al., 2012). In the first iteration, the DRIVER for which the reachability and the intersection sets are the same, occupy the top level in the ISM hierarchy (Soti, 2010), is removed from further consideration. This process continues until all the levels for the drivers are established. Iterations are used to define each level partition, and the results of the iterations are documented in Table 6.4. The iterations were completed in the fourth iteration, and the summary of the levels for each factor is presented Table 6.5. The summary of the levels is used to develop the diagraph of the ISM model.

Table 6. 4: Iterations

Diver code	Reachability Set	Antecedent Set	Intersection	Level
		Iteration 1		
D1	1,2,3,8	1,4,5,6,7,9,10	1	
D2	2,3,7	1,2,3,4,5,6,7	2,3,7	I
D3	2,3,8	1,2,3,4,5,6,7,8,9,10,11,12	2,3,8	I
D4	1,2,3,4,5,6,7,8,12	4,5	4,5	
D5	1,2,3,4,5,6,7,8,12	4,5,6	5,6	
D6	1,2,3,5,6,7,8,12	1,4,5,6,7	5,6,7	
D7	1,2,3,6,7,8,12	1,2,4,5,6,7	1,2,6,7	
D8	3,8	3,4,6,5,8,9,10	3,8	I
D9	1,2,3,8,9,10,12	9,10	9,10	
D10	1,2,3,8,9,10,12	9,10	9,10	
D11	3,11	11	11	
D12	2,3,12	4,5,6,7,8,9,10,12	12	
		Iteration 2		
D1	1	1,4,5,6,7,9,10	1	II
D4	1,4,5,6,7,12	4,5	4,5	
D5	1,4,5,6,7,12	4,5,6	4,5,6	
D6	1,5,6,7,12	1,4,5,6,7	5,6,7	
D7	1,6,7,12	1,2,4,5,6,7	1,6,7	
D9	1,9,10,12	9,10	9,10	
D10	1,9,10,12	9,10	9,10	
D11	11	11	11	II
D12	12	4,5,6,7,9,10,12	12	II
		Iteration 3		
D4	4,5,6,7	4,5	4,5	
D5	4,5,6,7	4,5,6	4,5,6	
D6	5,6,7	4,5,6,7	5,6,7	III
D7	6,7	4,5,6,7	6,7	III
D9	9,10	9,10	9,10	III
D10	9,10	9,10	9,10	III
		Iteration 4		
D4	4,5	4,5	4,5	IV
D5	4,5	4,5	4,5	IV

Table 6. 5: Summary of levels

Level	Drivers	Codes
1	Adequate and Detailed Designs and Specifications	D4
	Effective Project Planning And Supervision	D3
	Adequate and Effective Cash flow	D8
2	Stable Weather Conditions	D11
	Clear And Well Detailed Client Brief Competent	D1
	Effective resolution of Land compensation issues	D12
3	Stable Economic Environment	D9
	Stable Political Environment	D10
	Early Contractor Involvement	D6
	Effective Team Collaboration And Commitment	D7
4	Competent Contractor	D5
	Competent Design Team	D6

6.5.2.5 Diagraph of the ISM model

From the level partitioning table, the diagraph of the ISM is developed. Directional arrows depict the contextual interrelationships between the various drivers. The top-level of the model is a product of level 1 from the partition table. This order is followed in an ascending order until level 5 is placed at the bottom of the diagraph.

- ***Level 4***: Competent design team (D4) and competent contractor (D5) are located at this level- the base of the ISM model. These drivers have bi-lateral links hence facilitate each other and together facilitate the early involvement of the contractor (D6), and effective collaboration and commitment of the team (D7) on level 3. D4 and D5 are highly relevant drivers.
- ***Level 3***: Four drivers namely early contractor involvement (D6) and effective team collaboration (D7), table economic (D9) and stable political environment (D10) are located at this level. D6 and D7 have bilateral interaction with connections to the base while two D9 and D10 have bilateral interactions but disconnected from the base of the ISM. All four drivers directly facilitate clear and well-detailed client brief (D1), adequate resolution of land compensation disputes (D12) at level 2 and adequate and effective cash flow (D8) at level 1.

- ***Level 2***: Three drivers clear and well-detailed client brief (D1), adequate resolution of land compensation disputes (D12) and stable weather conditions (D11) are located. All three drivers have no bilateral relationships, but all directly facilitate effective project planning and supervision (D3) at level 1. Only D1 directly facilitate adequate and well-detailed designs and specifications (D2) on level 1. D11 also have no relationship with other drivers in level 2 nor the other levels from the base of the ISM model.
- ***Level 1***: Three drivers; detailed plans and specifications, (D2) effective project planning and supervision (D3) and adequate and effective cash flow (D8) are located. D2 and D3 have bilateral relationships and so does D3 and D8. These drivers in level 1 all depend on other drivers at various level to function effectively.

The diagraph developed is as shown in Figure 6.10.The diagraph reveals the following relationships from level 4 at the base to level 1 at the top of the model.

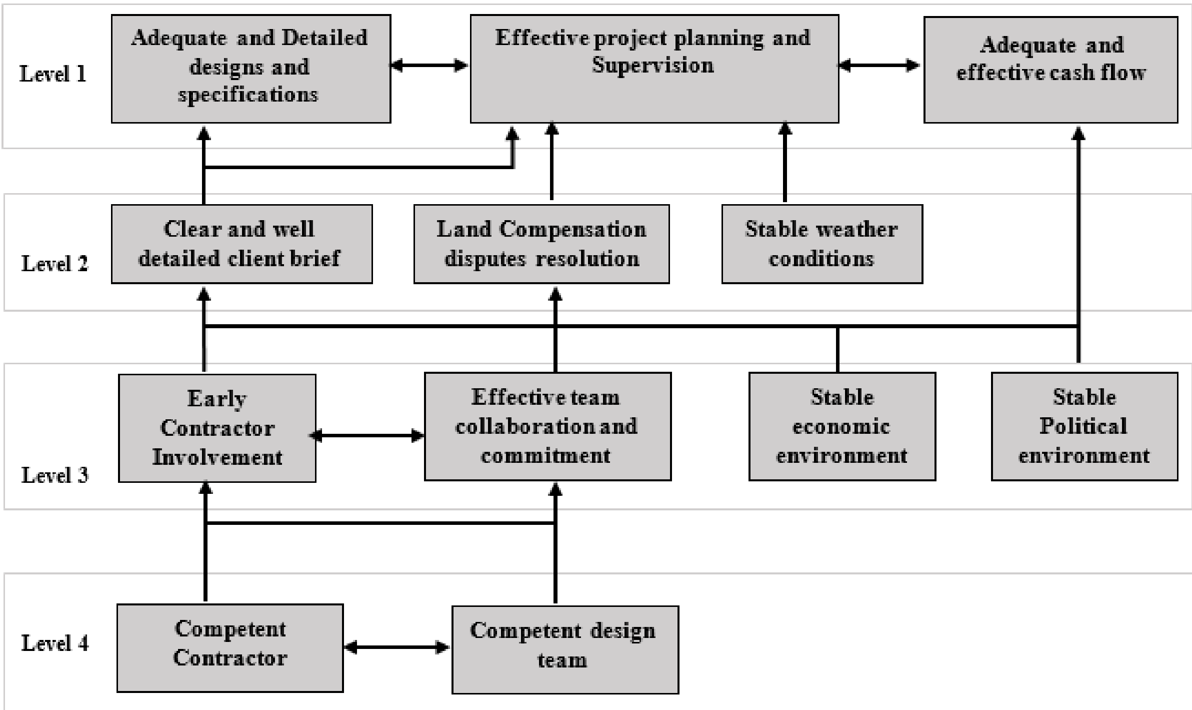


Figure 6. 10: ISM success driver model

The 12 drivers are subsequently analysed using the Matriced' Impacts Croises-Multiplication Appliqúe an Classement (MICMAC).

6.4.2.6 Driver Classification using MICMAC analysis

The objective of the MICMAC principle (Matrice d’Impacts Croises-Multiplication Appliqúe an Classment) is to help ascertain the degree of the relationships between the various drivers. The MICMAC uses the driver power and the dependence power of the drivers for its analysis. The MICMAC categorise drivers into independent, linkage, dependent, and autonomous clusters (Atrri et al., 2013). The autonomous cluster contains drivers that are weak and dependent and therefore are relatively disconnected from the system, though they may have a few links that may be strong. The Dependent cluster contains drivers that are weak but with a strong dependence on other drivers. Hence, they cannot function effectively without the help of other drivers. The linkage cluster: contain drivers that are both strong and dependent making them unstable as any action on them will have an effect on others as well as on them. While the Independent cluster contains drivers that are strong with weak dependence. Hence, possess the capability to influence other drivers and at such are highly relevant in a system.

The MICMAC ascertain the degree of the relationships between the various drivers using the power and the dependence matrix. The sum of scores along each corresponding row determines the power of a driver, while the sum of the scores along each corresponding column determines the dependence of a driver. The MICMAC uses scores from the final reachability matrix in Table 6.3, for analysis. The MICMAC classification table is documented in Figure 6.11. The MICMAC analysis results show that the drivers are classified into three respective clusters, and none of the drivers was found in the linkage cluster.

	INDEPENDENT						LINKAGE					
12												
11												
10												
9		D4	D5									
8				D6								
7				D7								
6		D9, D10										
5												
4							D1					
3							D12					D3
2	D11						D2		D8			
1												
0	1	2	3	4	5	6	7	8	9	10	11	12
	AUTONOMOUS						DEPENDENT					

Figure 6. 11: MICMAC analysis of the success drivers

- Independent Cluster: Four drivers were found in this cluster. These are;
    - ✓ Competent Design Team Professionals- D4
    - ✓ Competent Contractor Team- D5
    - ✓ Early Contractor Involvement- D6
    - ✓ Effective Team Collaboration and Commitment-D7

These drivers' based on the characteristics of this cluster are considered fundamental to the viable operation of other drivers in the system. Therefore can be considered highly important for CMS implementation.

- Dependent Cluster: Five drivers were found in this cluster. These are;
    - ✓ Adequate and Effective Cash Flow- D8
    - ✓ Effective resolution of land compensation issues-D12

- ✓ Adequate and detailed designs and specifications- D2
- ✓ Effective project planning and supervision-D3
- ✓ Clear and well-detailed client brief- D1

These drivers' based on the characteristics of this cluster are considered outcome drivers in the system. This is because they are very dependent on the other drivers to function effectively. As a result, they directly influence the planning and control process stages of the CMS.

- Autonomous Cluster: Three drivers were found in this cluster. These are;
  - ✓ Stable Economic Environment- D9
  - ✓ Stable Political Environment- D10
  - ✓ Stable Weather Conditions- D11

These drivers' based on the characteristics of this cluster are considered fundamental unimportant in the system. This is because the drivers have little influence on the system as they are neither powerful to facilitate others or depend on others to function, so can be excluded from the system.

6.5.2.7 Interpretation of findings from the ISM Model

The ISM structures a hierarchy of the IMS drivers. One of the advantages of the ISM in this context is that it highlights the most influential drivers that have to be carefully considered to achieve effective implementation within the CMS. This discovery will aid the PMT understand what drivers need to be carefully considered as a priority to attaining effective implementation in the CMS. The findings from the ISM show that competent design team and competent contractor D4 and D5 are the most important drivers in the control subsystem. They have the highest driving powers, and as such, should be considered as the most important for effective implementation within the CMS. The drivers at the top of the ISM model D2, D3 and D8 depend on these two drivers at the base to function effectively. D4 and D5 have bilateral interactions, which implies that they affect each other. Hence, the competence of the design team will affect the effective performance of the contractor team and vice versa. Competence connotes the knowledge, skill, and expertise. Therefore, the competence of the design team and contractor will directly enhance effective collaboration and commitment as shown by the upward arrow. It is also clear from the model that the knowledge and experience of the contractor is an advantage for their early engagement in the CMS process. A bilateral arrow between D6 and D7 implies that early contractor involvement affects the effective team collaboration and vice versa. Therefore, when the contractor is engaged early in the cost management process, the likelihood of effective team collaboration is high. Similarly, the need for effective collaboration will facilitate the early engagement of the contractor. Therefore, the competence of the PMT, early contractor engagement, and effective collaboration and commitment will lead to effective strategic decision making that can enhance the smooth implementation of cost management on the LcH project. For instance, the TC is a technique effectively implemented through the collaborative practice of the PMT. Therefore, these drivers will allow effective implementation of this technique in the process.

A clear client project brief (D1) is developed when the design and contractor team is competent, the contractor is engaged early in the process, and the PMT effectively collaborate and commit to the cost management objective. The diagraph also highlights upward arrow from stable political and economic environment (D9, D10) to development of client project brief. However, this link based on the MICMAC results is weak in the system. The client brief is an essential activity in the setting process stage need to arrive at the project target cost. The input from the client project brief is necessary for the implementation of the TC technique.

Furthermore, D4, D5, D6, D7, have upward links to the adequate resolution of land compensation issues. Hence, depend on D4, D5, D6 and D7 for practical ideas to mitigating such problems that could lead to vandalism and delays that may affect the control stage. Though an arrow shows an upward link between D9 and D10 to D12, however, results from the MICMAC analysis indicates that D9 and D10 influence is very low, and hence, a weak link which can be considerably ignored in the CMS implementation.

Drivers D4, D5, D6, D7 and D1, from the diagraph directly facilitate the development of adequate and detailed designs and specifications (D2). As shown by the upward arrow, it leads directly to the development of adequate designs and specifications (D2) which is a necessary ingredient to arriving at effective elemental cost targets at the planning and estimating process stage. D2 facilitates effective and accurate cost estimates development and effective planning and supervision (D3) during the planning and estimating, as well as the budgeting monitoring and control process stages. Cost estimates and budgets are derived from adequate and well-detailed designs and specifications to aid effective planning, and supervision on the project.

With effective planning and supervision in place, onsite resource can be controlled, cost performance index monitored based on real time performances during the control process stage. Effective project planning and supervision will directly facilitate adequate and effective cash flow and vice versa. This implies that with effective project planning and supervision, reports that can enhance adequate release of funds to the contractor during work process can be effective. Similarly, releasing the adequate funds needed for the project will aid continuous work progress and enhance effective planning and supervision. Diagraph also show that stable weather conditions (D11) also directly facilitate D3. However, from the MICMAC analysis, D11 is considered a weak link and can be ignored.

The MICMAC analysis result clearly shows that drivers D4, D5, D6 and D7 in the independent cluster can be considered highly influential followed by drivers D1, D2, D3, D8 and D12 in the dependent cluster. D9, D10, and D11 are considered irrelevant for consideration in the system. Drivers' D4, D5, D6, and D7 are associated with effective team qualities. D1, D2, and D3 are associated with effective information and management actions. Drivers' D8 and D12 are associated with stable operational environments. These nine drivers are retained by the ISM are influential for CMS implementation. Effective team qualities factor has four drivers are considered highly important, effective management information and actions have three drivers considered important and stable operational environment has two drivers also considered important. Based on this results, Effective team qualities factor is considered highly important, followed by effective management information and actions, finally stable operational environment. This information depicted in Figure 6.12.

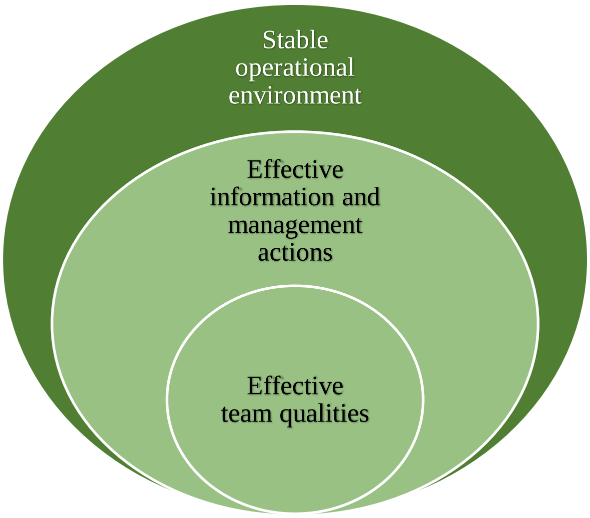


Figure 6. 12: IMSF relationship

Hence, both project sponsors and managers need to be able to ensure practices that ascertain the qualities of the PMT before they are engaged in LcH projects delivery. This IMSF will influence effective information and management actions that can create a stable operational environment.

The ISM provides a clear picture of the nine main drivers for effective implementation in the CMS however does not show their relationship with the performance pointers. To aid the PMT better understanding of how to use the CMSM effectively, it is expected that the drivers in relation to the performance pointer at each stage of the cost management process need to be clearly highlighted. In this regard, further analysis using the IRP technique can be beneficial.

6.5.3 Interpretive Ranking Process (IRP)

This technique developed by Sushil (2009) is a novel ranking methodology that combines the strength of the intuitive and rational choice processes for decision making that combines the analytical logic of the rational choice process with the advantages of the intuitive process at the elemental level. The methodology builds on the strengths of the paired comparison approach, which minimises the cognitive overload. It uses an interpretative matrix as a basic tool and paired comparison of interpretation in the matrix (Sushil, 2009). Furthermore, IRP does not require the information about the extent of dominance and makes an internal validity check via the vector logic of the dominance relationships in the form of a dominance system graph which is its main strength. Besides, it is easier to measure and compare the impact of interactions rather than the variables in an abstract sense (Haleem et al., 2012). Since its development, few studies (Table 6.6) have demonstrated the efficacy IRP with measurable performance indicators.

Table 6. 6: Interpretive Ranking Process in Documented Publications

Author	Publication
Luthra et al. (2014)	Critical success factors of green supply chain management for achieving sustainability in Indian automobile industry.
Sharma et al. (2014)	Analysis of Barriers to Lean Implementation In Machine Tool Sector
Mangla et al. (2014)	A flexible decision framework for building risk mitigation strategies in green supply chain using SAP–LAP and IRP approaches.
Haleem et al. (2012)	Analysis of critical success factors of world-class manufacturing practices: an application of interpretative structural modelling and interpretative ranking process.
Sushil (2009)	Interpretive ranking process

Source: Compiled by researcher from extant literature.

The researcher uses the IRP to map the relationship of the nine main IMSF drivers highlighted from the results of the ISM with measurable performance pointers for the cost management process using two sets of variables. One set of variables to be ranked (9 main drivers) and the other set of reference variables that provide the basis for the ranking (4 performance pointers of the cost management process). The drivers are represented by D1…Dn as used in the ISM.

- D1 Clear and well detailed Client project Brief
- D2 Well-detailed design and specifications
- D3 Effective project planning and supervision
- D4 Competent design team
- D5 Competent Contractor
- D6 Early Contractor involvement from predesign
- D7 Effective team Collaboration and commitment
- D8 Adequate and Effective Cash flow
- D12 Adequate resolution of land compensation issues

While the performance indicator and cost management process stages represented by P1, P2, P3 and P4 respectively. Where

- P1= Effective target cost at setting stage
- P2= Effective elemental cost target at planning and estimating stage
- P3= Effective operational cost baseline at budgeting stage
- P4= Effective real time cost performance index and update at monitoring and control stage

The following steps as elucidated by Sushil (2009) were employed in the IRP procedure.

6.5.3.1 Determine the cross-interaction matrix

This matrix shows the existence or nonexistence of the contextual relationship between the nine drivers and the cost management process stages. Numeric '1' defines a presence of relationship (exist), and '0' defines its absence. The cross-interaction matrix is developed and shown in Table 6.7. Afterward, the cross-interaction matrix is converted into an interpretive logic matrix.

Table 6. 7: Cross interaction matrix for the drivers

Drivers	**Performance pointers of the Cost Management Process**			
	P1	P2	P3	P4
D1	1	1	1	1
D2	0	1	0	1
D3	0	1	1	1
D4	1	1	1	1
D5	1	1	1	1
D6	1	1	1	1
D7	1	1	1	1
D8	0	0	0	1
D12	0	0	0	1

6.5.3.2 Develop the interpretive logic matrix

This matrix displays the conversion of the cross-interaction binary matrix into an interpretive matrix becoming the basic data needed for comparison for ranking the nine drivers. This statement implies that all the interactions between the drivers and the sub-processes are interpreted in contextual relationships (Table 6.8).

Table 6. 8: Interpretive Logic matrix

Drivers	P1	P2	P4-	P4
D1	Information needed to determine target cost	Directly facilitate effective cost planning		
D2		Directly facilitates effective elemental cost targets		indirectly facilitates effective feedback for project control during construction
D3			directly facilitates preparation of cost baseline and work breakdown structure	directly influence effective onsite resource control
D4	Expertise needed to determine target cost	Expert judgement in cost planning and estimating	Expertise needed to develop operational cost baseline and cost breakdown structure	Expertise needed to operate techniques for effective cost control
D5	Expertise needed to determine target cost	Expert judgement in cost planning and estimating	Expertise needed to develop operational cost baseline and cost breakdown structure	Expertise needed to operate techniques for effective cost control
D6	Cost feedback needed to determine Tc	Expertise and team collaboration for effective cost planning & arriving at elemental cost targets	Expertise and team collaboration in effective develop operational cost baseline and cost breakdown structure	
D7	Comprehensive expertise practice to arrive at the TC	Comprehensive expertise practice for effective cost planning & elemental cost targets	Comprehensive expertise practice to effectively develop operational cost baseline and cost breakdown structure	Expertise and team collaboration during site meetings towards effective cost control
D8				Facilitates effective cash flow analysis and onsite resource control
D12				influence onsite resource control practice

6.5.3.3 Derive the dominating interaction matrix

This is the next step in the IRP. The ranking variables are not directly compared to the cost management processes stages but the performance pointers. All the dominating interactions are summarised in the dominating interaction matrix, as shown in Table 6.9.

Table 6. 9: Dominating interaction matrix

	D1	D2	D3	D4	D5	D6	D7	D8	D9
D1	-	P1P2	P1	P1	-	-	P1	P1	P1
D2	-	-	P2	-	-	P4	-	P2	P2
D3	P3P4	P3P4	-	P4	P4	P4	P4	P4	P4
D4	P2P3 P4	P1P2P3 P4	P1P2P3	-	P1P2 P3	P1P2P3 P4	P1P4	P1P2 P3P4	P1P2P3 P4
D5	P2P3 P4	P1P2P3 P4	P1P2P3	P4	-	P1P2P3 P4	P1P4	P1P2 P3P4	P1P2P3 P4
D6	P2P3	P1P3	P1P2	-	-	-	-	P1P2 P3	P1P2P3
D7	P2P3 P4	P1P2P3 P4	P1P2P3	P2P3	P2P3	P2P3P4	-	P1P2 P3P4	P1P2P3 P4
D8	P4	P4	-	-	-	-	P4	-	P4
D12	P4	P4	-	-	-	P4	-	-	-

6.5.3.4 Develop the dominance matrix

The dominance matrix presents the number of cases in which one ranking variable dominates or is dominated by another in a number of dominating interactions (Sushil, 2009). In this matrix, the sum of the row and column gives the number of cases a particular ranking showing a particular variable is dominated or being dominated respectively. The number dominating in a column in represented by CD and the corresponding number being dominating in a row is represented by RD. Therefore, the difference between CD and RD is the net dominance for a ranking variable as shown in Table 6.10.

Table 6. 10: Dominance Matrix – Ranking of Implementation drivers with performance pointers of the cost management Processes

	D1	D2	D3	D4	D5	D6	D7	D8	D9	Dominators	Net Dominance	Ranks
										R^D	(R^D- C^D)	
D1	0	2	1	1	0	0	1	1	1	7	-8	6
D2	0	0	1	0	0	1	0	1	1	4	-16	8
D3	2	2	0	1	1	1	1	1	1	10	-3	5
D4	3	4	3	0	3	4	2	4	4	27	22	1
D5	3	4	3	1	0	4	2	4	4	25	19	2
D6	2	2	2	0	0	0	0	3	3	12	-2	4
D7	3	3	3	2	2	3	0	4	4	25	18	3
D8	1	1	0	0	0	0	1	0	1	4	-14	7
D12	1	1	0	0	0	1	0	0	0	3	-16	8
C^D	15	20	13	5	6	14	7	18	19	116 Total Interactions		

6.5.3.5 Develop the interpretive ranking model (IRM)

The ranks obtained from the dominance matrix are presented in a diagram known as the IRM (Figure 6.13). This model displays the final rankings of the nine drivers with the performance pointers of cost management process. The IRM displays how each driver influences the various pointers. In the IRM, all the drivers analysed to show the numbers dominating and being dominated summarised in brackets (Sushil, 2009). The confidence of building the ranks was validated through a structured walkthrough of the variables, interactions, and process, as well as through expert validation.

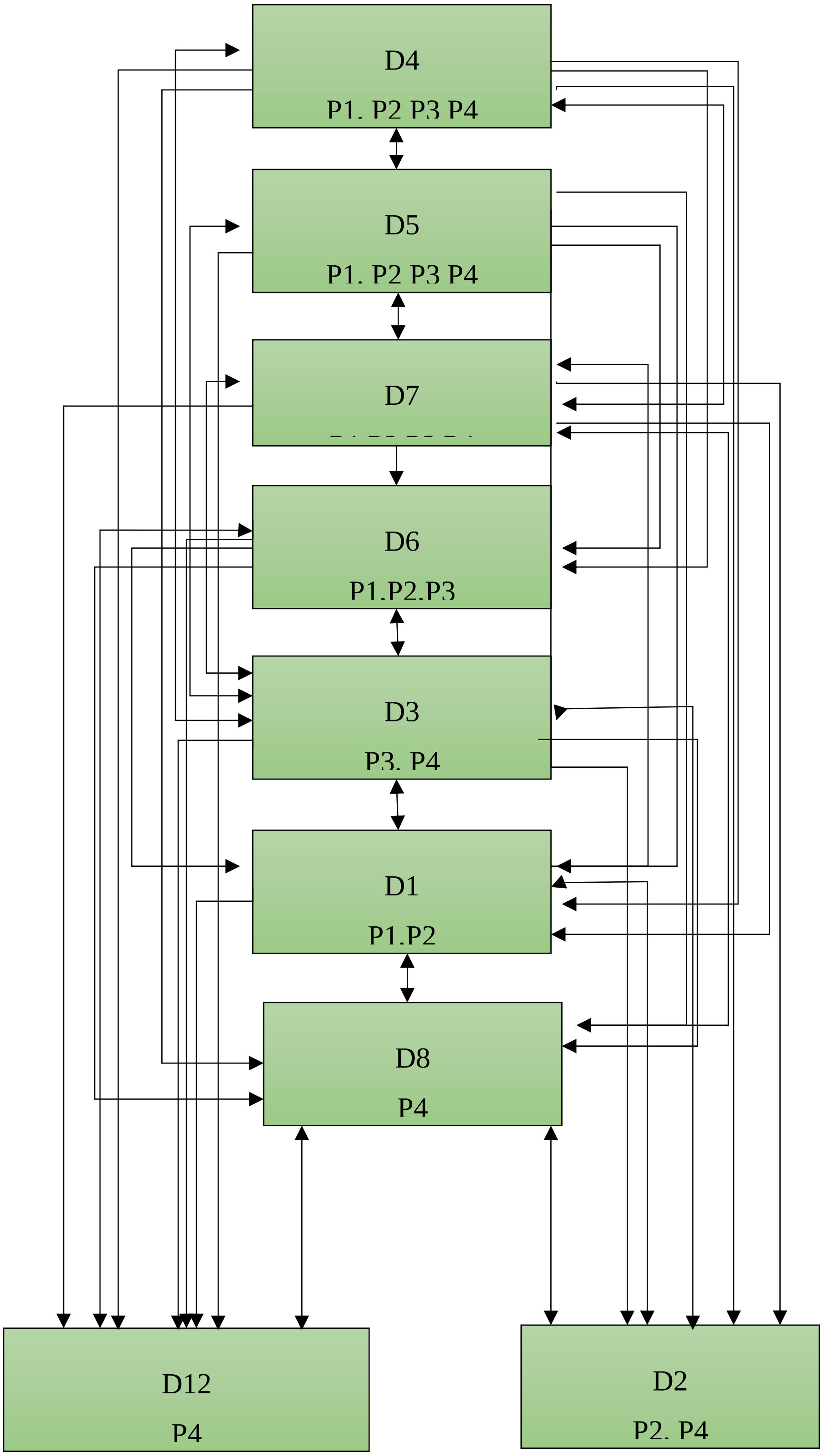


Figure 6. 13: IRP Driver Model

6.5.3.6 IRP model interpretation

From the interpretive ranking model, the ranks of the main drivers with the performance pointers of the CMS process are illustrated. The model shows eight rankings. The rankings of the other drivers in descending order are1stcompetent design team, 2nd competent contractors, 3rd effective team collaboration and commitment, 4th early contractor involvement, 5th effective project planning and supervision, 6th clear and well-detailed client brief, 7th adequate cash flow and 8th detailed designs and specifications and adequate resolution of land compensation issues. Unlike the ISM model that establishes a relationship between the drivers, the IRP establishes a relationship between one driver and the performance pointer at each process stage. Therefore, the drivers ranked with the CMS process have either a direct or an indirect influence to ensuring effective performance at each stage of the process.

The model clearly indicates that the most important driver to be considered for effective implementation within the CMS process is a competent design team (D4) as it is given the highest ranking by IRP. This driver is dominating, and hence, needful for all operations at all stages of the cost management process to achieve the stated performance pointers. The next important driver is competent contractors (D5). As shown in the IRP model, it is the second high-ranking driver needful in all stages of the cost management process to achieve the performance pointers. Next, is effective team collaboration and commitment (D7). As shown in the IRP model, it is the third high-ranking driver needed in all stages of the cost management process to achieve the performance pointers. Early contractor involvement (D6) is the fourth high-ranking driver. This driver dominates only three process stages; setting, planning and estimating and budgeting. Hence, needful to achieve the performance pointers associated with the identified stages. Next is effective project planning and supervision (D3) followed by clear and well-detailed client brief (D1) which dominates only two process stages each. Next after D1 is adequate and effective Cash flow (D8). This driver is useful to achieve the performance pointers at the monitoring and control process stage. Finally, is an adequate resolution of land compensation issues (D12) and well-detailed design and specifications (D2). These factors are at the bottom of the IRP model and rank 8th. D12 and D2 are identified to have indirect usefulness in effective monitoring and control to achieve effective cost performance index. However, despite D2 influence in planning and estimating process stage to arrive at effective elemental cost budget, it is yet ranked 8th because, at this stage, other drivers are seen as stronger dominators.

Based on the findings of the IRP model, it is seen that drivers associated with effective team qualities, especially a competent design team have high dominance across many performance pointers associated with each stage of the CMS process. Therefore, it is important that members of the project design team possessed the relevant and required skill, knowledge, and professional experience and capacity needed to make the appropriate choice of effective techniques and understand their application within the cost management process in the LcH project. The same goes for the contractor team as such qualities have the potential to enhance effective team collaboration and commitment to project objective that is also an important driver. The project manager needs to ensure this clarity before engaging organisations that constitute the design team of the PMT. The competent design team and competent contractor dominate the CMS on the four performance pointers in the cost management process: achieving the target cost, effective elemental cost targets, development of effective cost baseline, and real-time variance and to completion reports. These drivers associated with effective team qualities have also emerged as the most important drivers of the CMS in the ISM model. The nine drivers on each CMS process stage are considered relevant to develop the third draft of the model.

6.5.4 Findings of CMSM Design Methodology

Findings from the process model, the ISM, and IRP establish the relationship between the techniques, process and the IMSF. The findings from these approaches are integrated into the third draft of the model. The third draft model in Figure 6.14 was an adaptation of the findings from the case study and model development process. The model is structured to reflect the relationships between the techniques process and expected outcomes reflecting the LcH project delivery stages and their constant interaction. The project stages are a reference point to reflect the system’s implementation procedure in reality. It captures only the cost management related activities within these stages. No further attention is given to exploring further activities ongoing within these stages as it is outside of the scope of this research.

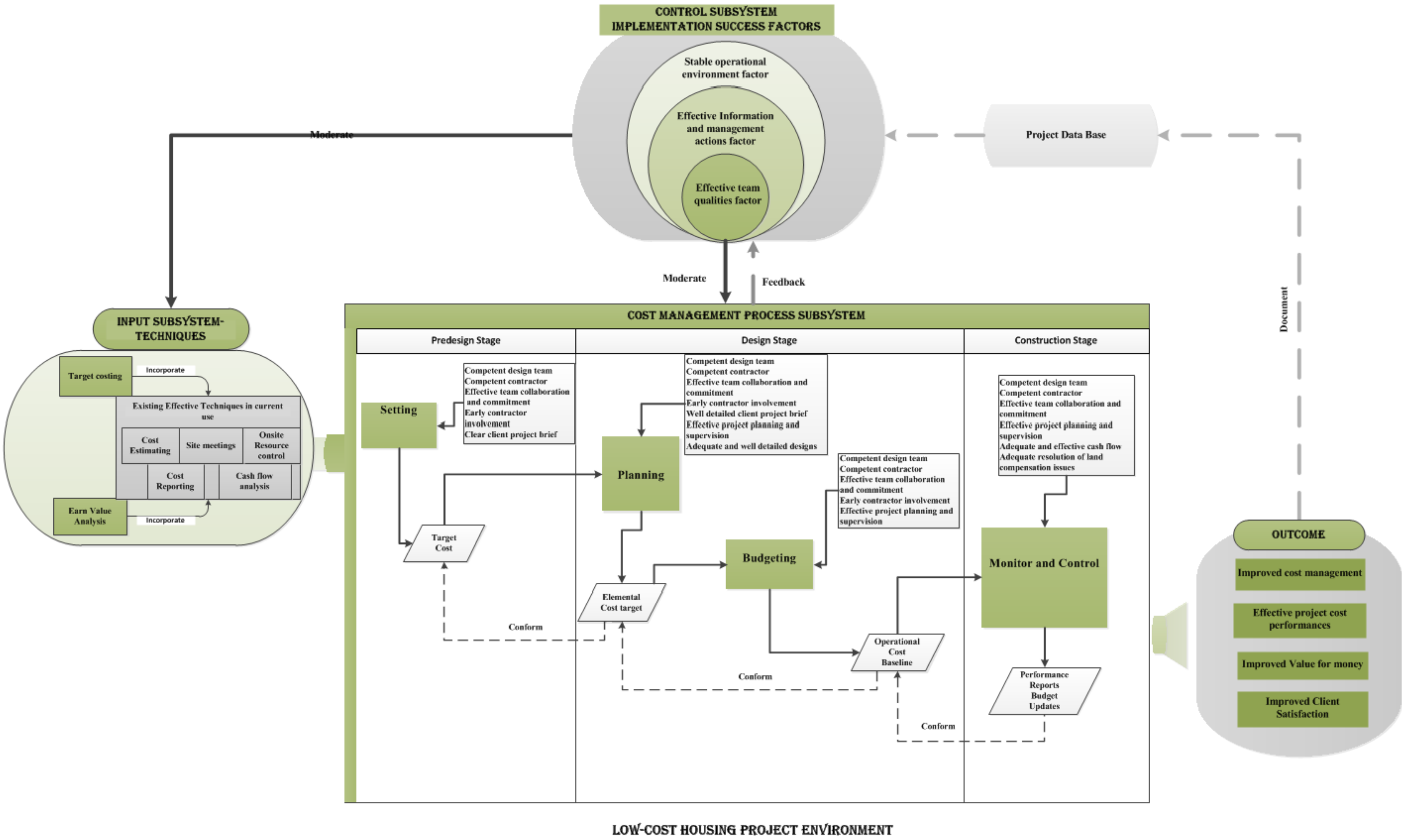


Figure 6. 14: CMSM Third draft

To the left of the CMSM- input subsystem is seven techniques identified as effective for project cost management. Whereas five of the techniques are popularly used, two, TC and EVA, are the newly introduced techniques. These techniques integrated are for technical improvements for the setting, planning, and control processes for better outcomes. Regulating the techniques and process implementation are three important IMSF in the control subsystem. The IMSF drivers feed into the each process stage to achieve the performance pointers alongside the techniques. Furthermore, the researcher also shows the order of relationship of the success factors with effective team quality factor as most important followed by effective information and management actions and finally stable operational environment. Consequently, the third draft of the CMSM is subjected to validation. It is expected that this understanding would enable the PMT to implement effective cost management in LcH project delivery.

6.6 CMSM VALIDATION

Model Validation is the process of determining the degree to which a model is an accurate representation of the real world from the perspective of the intended users of the model (Thacker et al., 2004). Therefore, validation ensures that the model can be used to meets its intended requirements regarding the methods employed, to address the right problem and to obtain good results (Macal, 2005). According to Patton, (2003) validation involves getting reviews from experts who have been involved in the earlier phases of the research process to examine and comment on the findings, accuracy, and completeness on the outcome of the research. The CMSM validation process involves the researcher who developed the model through a rigorous process: identifying and analysing the key themes and concepts, and the research community constituting the respondents and participants from industry (i.e. the HAST, CST, and CNT) and academia (ACA).

The purpose of the CMSM validation is to refine and assess the clarity, appropriateness, and usefulness of the proposed conceptual model for improved cost management on the LcH projects in the Nigerian southeast zone and develop an operational guide for its users. The following objectives were structured for the validation process:

- To ascertain if the CMSM is an accurate representation the structure of the CMS in reality.

- To clarify if the various techniques, process approach, and IMSF represented in the CMSM are appropriate and effective to improve CMS cost management and performance outcomes
- To clarify the relationships within the techniques, process, and success factors in the CMSM
- To determine if the CMSM can be easily understood and implemented by its users
- To ascertain the usability of the operational guide for the CMSM
- To clarify if the CMSM will assist the project management team in effective project cost management towards improved low-cost housing project cost performances in the Nigerian southeast zone

The validation process was conducted in two phases using the following data collection methods:

- Initial validation phase- Focus group interviews
- Final validation phase- Semi-structured interviews

6.6.1 Initial Validation Phase

This phase focused on identifying the relationships between the various subsystems in the CMSM and the appropriateness of their components towards ensuring that the model could be easily understood and used by the intended users (PMT). For the initial validation phase, 10 participants were purposively selected and contacted based on their knowledge of project cost management involvement in the LcH project delivery and had at least ten years of work experience were contacted. The researcher viewed this as important to provide adequate information critical to refine the CMSM was appropriate and develop the operational guide before final validation. The 10 participants contacted were involved in first data collection stage (i.e. semi-structured interviews).However, only six out agreed and were available to participate. They were comprised of two each from HAST, CST, and CNT. Also, two other participants from academia were also contacted and were willing to participate. These experts did not take part in the previous data collection stages. Hence, eight participants were involved in the focus group interviews. Their profiles are presented in Table 6.11.

Table 6. 11: Validation participants profile

Participant	Job Title	Professional background	Construction industry experience (years)	Cost management practice experience (years)	LcH projects experience (years)
HAST 1	Project manager	Quantity surveyor	25	25	17
HAST 2	Project supervisor	Architect	16	11	13
CST 1	Consultant QS	Quantity surveyor	10	10	10
CST 2	Consultant Arc	Architect	19	19	15
CNT 1	Site manager	Builder	13	13	9
CNT 2	Site manager	Architect	15	15	7
ACA 1	Academia/Consultant	Quantity Surveyor	21	32	4
ACA 2	Academia/ Consultant	Structural Engineer	19	19	5

Source: Field Survey (2016)

The participants all participated in the focus group interviews used to refine the third draft of the CMSM. The results from the validation as presented in the subsequent sections.

- ***Question1: Is the CMSM a true representation of the structure of the CMS in reality?***

This objective of the validation process was to ascertain if the CMSM accurately represented the various subsystems in the cost management system employed in LcH projects. All the interviewees agreed that the CMSM depicted a good representation of all the subsystems within the CMS in reality and expected outcomes. They further acknowledged that the identification and representation of the control system as a subsystem was quite thoughtful as these were not usually taken into consideration. This established that the model truly represents what it sets out to represent. In their comments:

> ***HAST:*** "Yes the techniques the process stages and output are the three main subsystems. This control subsystem is very thoughtful. It actually a subsystem I thing we have failed to acknowledge within the main system".

> ***CST*** added, that: "...yes, this models the real system in graphical form. How the techniques flow into the process and then outcome. The control subsystem is really a good it is existent but I would not have thought about it as a subsystem. It is really good you have shown it in your model because it has created awareness".

The views of the HAST 1 and CST 2 were in consensus agreement by all the participants

- ***Question 2. Does the CMSM clearly represent the relationships between the techniques, process and success factors in a CMS?***

All the interviews acknowledged that the CMSM is simplistic and understandable as the relationship between the subsystems are clearly represented. According to

> ***HAST 2:*** "To be most sincere this model is really informative it highlight the techniques and the process stages and their relationship… that I tell you makes it very clear and anyone with it can go straight to implement without asking you a question".

However, the HAST and ACA suggested that within the input subsystem, the techniques flow of relationship should be represented. In a comment by ACA,

> ***ACA:*** "Representing the techniques are good but it much simplistic to show the how the techniques link with each other".

This was agreed by five other participants.

- ***Question 3. Can the improved cost management system lead to the possible performance outcomes as modelled in the CMSM?***

There was a consensus amongst all the interviewees that the effective techniques both existing and new, the cost-design- control approach, and the IMSF all represented in the CMSM are appropriate and can be considered effective to improve the performance of the current CMS in LcH project delivery in the zone. They particularly expressed pleasure with the identification of the IMSF in the CMSM which in their comment was an innovative integration. According to CNT,

CNT: "To tell you the truth I am knowledgeable on critical success factors for cost performance but you have identified these factors in specific context of cost management system and I tell you it is very novel".

However, two of the interviewees questioned the exclusion of the cost planning technique in the planning process stage. According to ACA

ACA: "Cost planning is a critical technique for effective project cost management, I wonder why it was not included".

The researcher drew their attention to the earlier presentation on the research process where it was explained that the TC embodies a more detailed approach of the cost planning technique in its procedure. In this regards ACA 2 acknowledged, satisfaction. According to ACA 2:

ACA: "ooh I see, in that case the concern is taken care of".

- ***Question 4. Is the CMSM clear and easily understood by its users?***

The participants all agreed that the CMSM is simple and can be easily understood. According to ACA,

ACA: "I tell you this is very informative it replicates the specific requirement to put in place. But if a sketch plan on how to implement this model is also available it will be well appreciated and much easier during implementation".

This comment was in corroboration with the comments by the seven other participants.

However, six of the interviewees clearly indicated that reflecting the IMSF drivers in each process stage will be helpful for easy implementation and understanding. In one of the comments by CNT,

CNT: "We know that effective team qualities are needed but we also need to clearly identify the key drivers to know what exactly what to look out for. It needs to be specific and clear".

Furthermore, they suggested the possibility of a documented operational guide to assist PMT in implementing the techniques and drivers of the success factors at each process stage as integrating all into model might make the CMSM too ambiguous.

The responses gathered from the initial validation exercise revealed that the CMSM accurately represent an improved CMS in reality. In addition, they expressed pleasure in the thoughtfulness of integrating the IMSF in the control subsystem. However, they suggested refinement in the following areas for better implementation:

- The clear links between the techniques in the input subsystem.
- Appropriate techniques reflected for each process stage in the model.
- An operational guide to be used with the CMSM to assist PMT in step by step guide to achieve effective cost management as integrating it into the CMSM will make it too ambiguous.

Given the findings, feedback and recommendations from the initial validation phase, the researcher proceeded to develop the fourth draft of the model as shown in Figure 6.15. In this fourth and final version of the model, proper consideration was given to reflect, the relationship between the techniques and appropriate technique for each process stage.

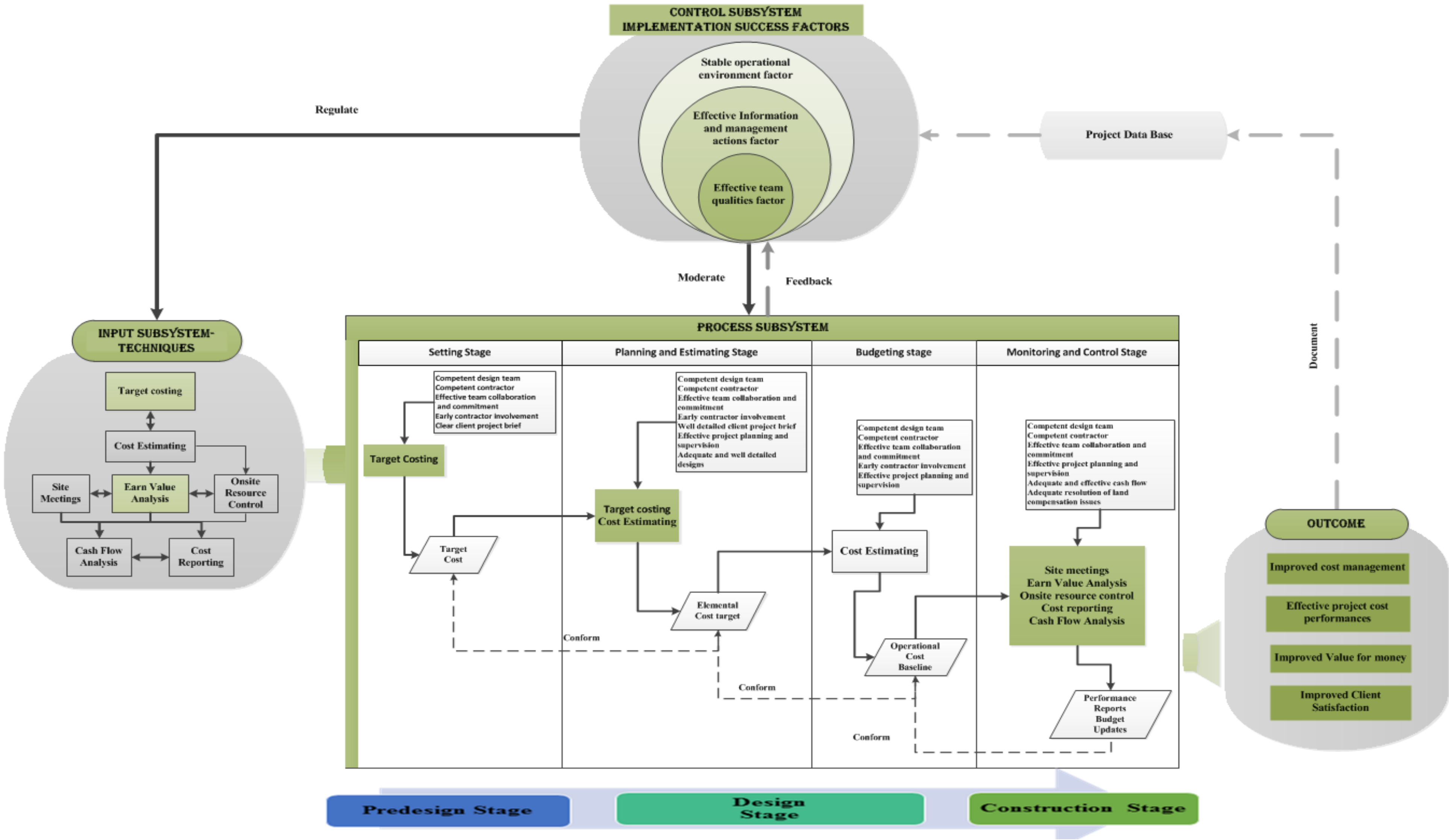


Figure 6. 15: CMSM final draft

6.6.2 Operational Guidelines for Implementing the CMSM

Implementing the CMSM begins with an understanding of the appropriate techniques, the process approach, and the prioritised drivers needed to achieve the performances pointer at each stage of the cost management process. The operational guide for the CMSM is detailed in Table 6.12 - 6.15.

- From the CMSM, at the setting stage the three drivers: competent design team, competent contractor, and effective team collaboration and commitment in addition to early contractor involvement and as well as detailed client brief is expedient to implement target costing appropriately to arrive at effective target cost for the project. The collaborating effort of the PMT is needful to set the target cost at AC or ABM. Setting the target cost is a very critical decision. The target cost provides a lead into the next process stage planning and estimating.
- At the planning and estimating stage, seven drivers associated with both effective team qualities and management actions are needed to implement the target costing and cost estimating techniques to achieve effective elemental cost targets needed to develop cost-effective designs for the project. The elemental cost target is used as a guide for the next process stage budgeting.
- At the budgeting stage, there are five success drivers: competent design team, competent contractor effective, team collaboration and commitment, early contractor involvement, and effective project planning and supervision are consequent drivers associated with effective team qualities and management actions. All these are needed to implement the cost estimating technique to produce effective operational cost baselines helpful in the monitoring and control process stage.
- At the monitoring and control stage, there are six success drivers: competent design team, competent contractor, effective team collaboration and commitment, effective project planning and supervision, adequate and effective cash flow, adequate resolution of land compensation issues associated with effective team qualities, management actions and a stable operational environment. They are needed to effectively implement the five identified techniques to achieve real-time monitoring and cost performance updates.

Table 6. 12: Operational guide – setting stage

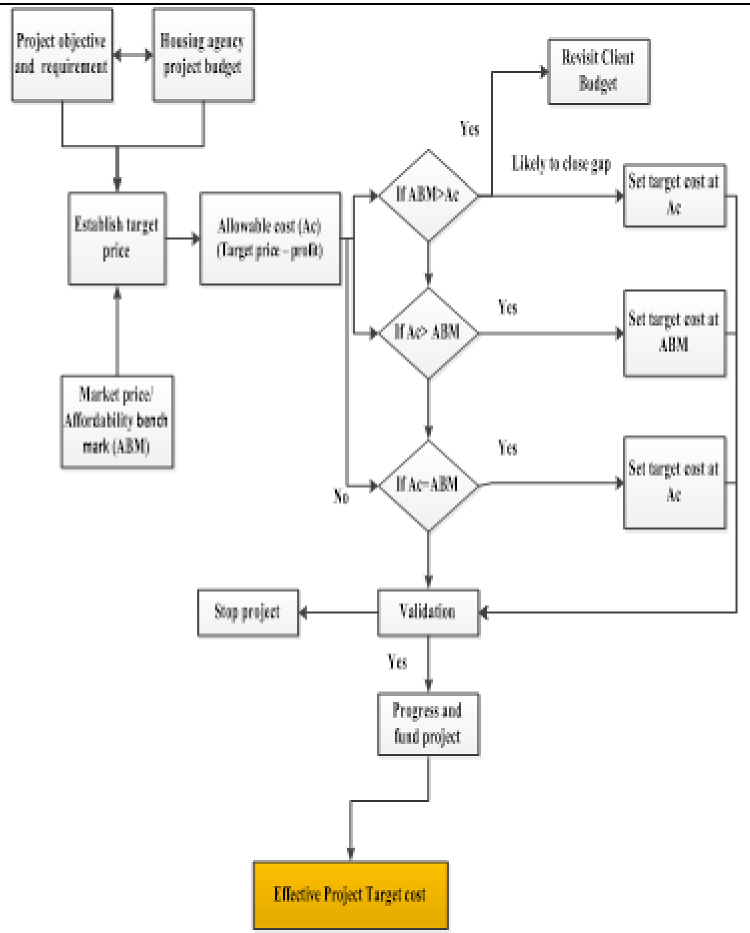
<table>
<tr><th>Success Drivers</th><th>Techniques</th><th>Process stage</th><th>Procedure</th><th>Performance Pointer</th></tr>
<tr><td>• Competent design team
• Competent contractor
• Effective team collaboration and commitment
• Early contractor involvement
• Well detailed client project brief</td><td>• Target Costing</td><td>Setting</td><td>
</td><td>Target project cost</td></tr>
</table>

Table 6. 13: Operational guide – planning and estimating stage

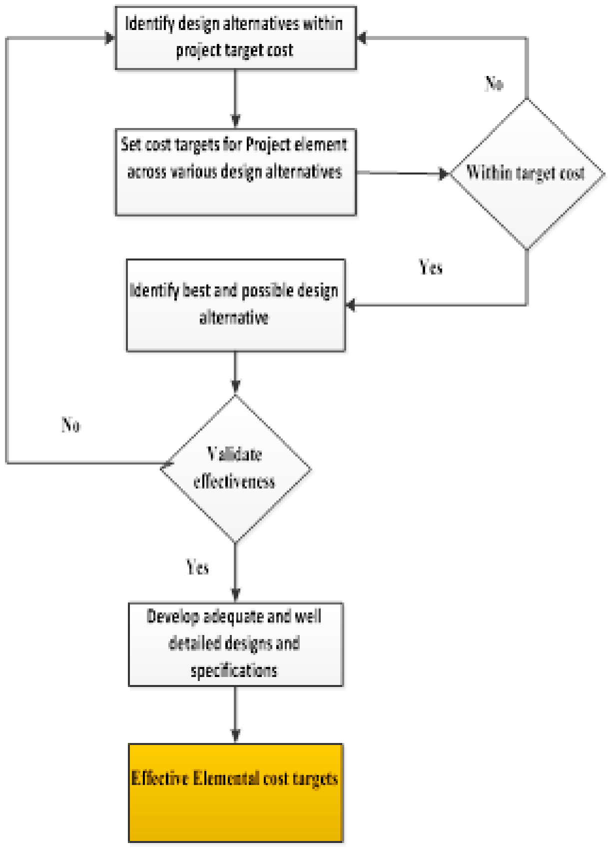
IMSF Drivers	Techniques	Process stage	Procedure	Performance Pointer
• Competent design team • Competent contractor • Effective team collaboration and commitment • Early contractor involvement • Well detailed client project brief • Effective project planning and supervision • Adequate and well detailed designs	• Target costing • Cost estimating	Planning and Estimating		Effective elemental cost targets

Table 6. 14: Operational guide – budgeting stage

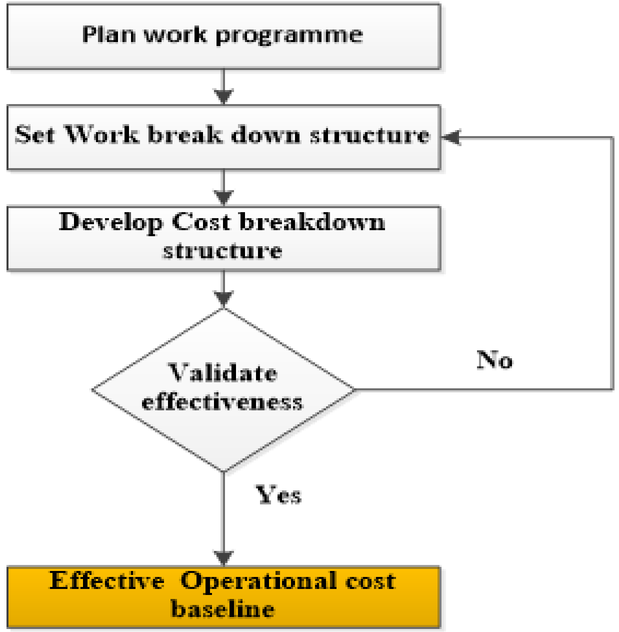
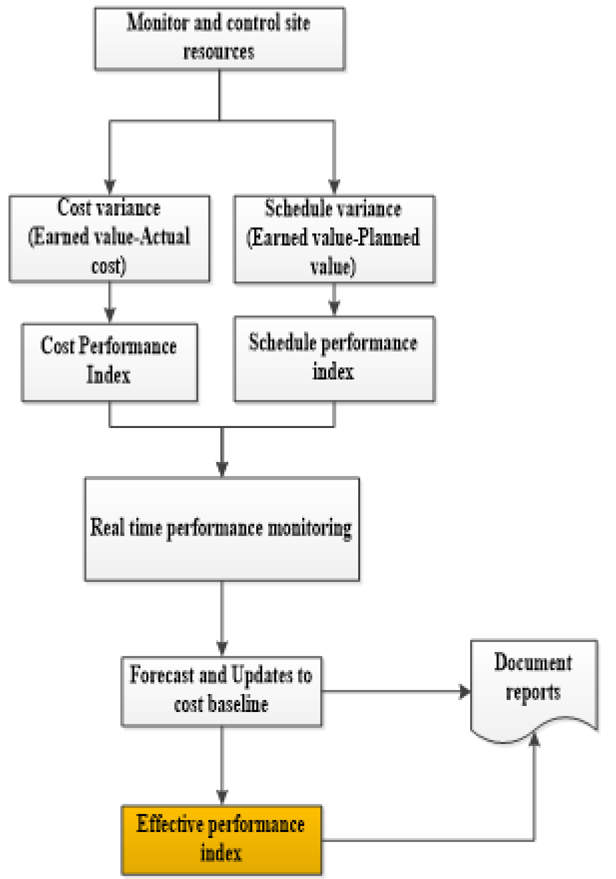
IMSF Drivers	Techniques	Process stage	Procedure	Performance Pointer
• Competent design team • Competent contractor • Effective team collaboration and commitment • Early contractor involvement • Well detailed client project brief • Effective project planning and supervision	• Cost estimating	Budgeting		Effective operational cost base line

Table 6. 15: Operational guide – monitoring and control stage

IMSF Drivers	Techniques	Process stage	Procedure	Performance Pointer
• Competent design team • Competent contractor • Effective team collaboration and commitment • Effective project planning and supervision • Adequate and effective cash flow • Adequate resolution of land compensation issues	• Cost estimating • Earn Value Analysis • Onsite resource control • Cost reporting • Cash flow analysis • Site meetings performance review	Monitoring and Control		Effective real-time cost performance and To- completion forecast

Understanding the most suitable techniques, process approach (Kern &Formoso, 2006; Obi &Arif, 2015), and key IMSF is crucial for CMS effective. However, without a proper translation of these concepts in a model and guide that can easily be understood by the PMT will not provide a platform that encourages their enactment. From the operational guide, the PMT is detailed on what technique and IMSF driver to use as well as the procedure for the techniques to achieve the performance pointers at each stage of the cost management process. The drivers associated with effective team qualities are highly influential, hence, should always be prioritised.

The final draft of the CMSM and the operational guide are subsequently presented to experts for validation employing semi-structured interviews. The reports from the validation phase are discussed in the next section.

6.6.3 Final Validation Phase

Phase two is the final validation phase. The focus of this stage is to:

- Ascertain the usability of the CMSM and guide in real life context
- Ascertain that the emergent model will assist the PMT achieve effective cost management and performances in LcH project delivery.

It was the intention of the researcher to test the CMSM on real life projects as a method of validation in this phase. However, because of the change in the political environment in the country with the change of new government administration in 2015, many intended LcH projects are yet to be commissioned and existing projects put on hold. This change also affects the commissioning of LcH projects in many parts of the country including the Nigerian southeast zone. As an alternative, the researcher decided to rely on expert opinions for the final validation of the model. The researcher adopted the use of semi-structured interviews because it is intended that each sub-teams of the PMT are expected to be able to use the model and guide. Therefore, their understanding of CMSM and its operational guide is a decisive advantage for its validation.

The final validation interviews were conducted with the same participants except for the academia experts and the following validation questions were asked.

- ***Question 1. Is the CMSM and guide usable in real life context?***

This question aims at identifying the usability of the CMSM in real life context following the modifications. The interviewees acknowledged that components are adequately represented and can be understood and that the CMSM is usable in real life context. Some of the comments by the participants are as follows:

> ***HAST:*** "The model shows the management system what to put in place and the operational guide how to put them in place. With these, it can be easily implemented. It is just like a drive through video presented in words and symbols".
>
> ***HAST:*** "This is much clearer and understandable. As you can see the drivers can be easily identified in the model and this is also highlighted in the operational guide. Not that we see the success factors and we can identify its drivers in the operational guide".
>
> ***CST: "***The model shows the outcome of what should be the ideal picture. In the case of your model, the techniques are identified, the process stages and the success factors you exactly know what technique to use at each stage and the drivers to put in place to determine the project target cost, plan within the target cost and monitor and control within same then what can be more helpful. I believe this is a good innovation and a platform for future improvements".
>
> ***CST:*** "if you have knowledge of a thing and can understand its use then I don't see its implementation as difficult. It shows the structure and the process to implement. So yes, the model and the operational guide is well presented and detailed and I can easily follow its process and implement it".
>
> ***CNT:*** "Believe me, the model is definitive, and the operational guide is self-explanatory that makes it easy to follow."
>
> ***CNT:*** "Yes, it clear and I can easily use it following the represented process. Just take a look at the control process for example, you know the drivers, you know the techniques and then it highlights where they fall for appropriate use".

These comments corroborate those espoused by all the other interviewees from the HAST and CNT.

- ***Question 2: Can the CMSM and its guide assist the PMT to achieve effective project cost management and performances?***

This question aims to identify whether the CMSM developed can assist the PMT to improved cost management on the LcH projects in the zone. All the participants acknowledged that the CMSM would definitely assist the project management team to improve project cost management on low-cost housing projects in the zone towards improved cost performances. The interviewees from the CST, HAST, and CNT in their corroborated comments espoused that:

> ***CST:*** "We have no standardized system to implement cost management. Although we are also involved in the cost management practice on these projects, it has been solely the responsibility of the quantity surveying consultants. However, with this model, we also have an idea on what to as a team and acts as a check for us as a team. So I can tell you that the model is quite beneficial".

> ***HAST:*** "This model is important and beneficial. As a team, it will helps us to work as a together throughout the process. We all have the knowledge of what is expected, and we can act on the same page at each stage. As a housing agency staff, we are there to monitor the cost management process so with the model which shows the management system it is also a way to standardise our operations for effective monitoring. We know what should be done and outcomes to be expected. With the right techniques, success factors and drivers in place for each stage in the cost management process, we can improve our performances and predict what to expect. So, it is an excellent strategy that can improve our cost management process and performance outcomes".

> ***CNT:*** "The lack of a framework is one of the problems we are facing in the cost management practice. We employ different systems to manage cost which makes it so difficult for team work and continuity. I believe our technical input and the factors we need to put in place will definitely improve our management process and influence our successful outcomes on cost performances".

The responses gathered from the semi-structured interviewees revealed that the CMSM and the operational guide could be easily understood and implemented accurately as it represents the various techniques and success factors and drivers appropriate for each process stage. They also concluded that the CMSM and its guide:

- Easily understood for information and implementation purposes
- Usability in real life context
- Provides feedback and check for the PMT to implement effective project cost management in the low-cost housing project delivery in the Nigerian southeast zone
- Facilitates effective collaboration by the PMT to implementing the cost management practice on the LcH projects
- Provides a standardised CMS that will facilitate continuity and quality improvement of performances by the PMT, both as a team and individual professionals

6.7 CHAPTER SUMMARY

In this chapter, the design development and validation of the CMSM for improved cost management on LcH project delivery was discussed. The chapter gave an account of the systematic structure of the techniques sub-processes and success factors that can lead to effective management and performance outcomes in regards to project costs. It also highlighted the operational guide which illustrates in more detail the techniques alongside the drivers associated with the success factors in the process subsystem to guide its effective implementation by the PMT. The final CMSM draft has evolved based on the findings, feedback, and recommendations of participants and respondents who have been involved in the research process at the qualitative and quantitative phases of data collection and the initial validation process.

The feedback on the CMSM validation clearly shows that the model is an accurate representation of the system in reality; the components (techniques, process and success factors and their drivers) have clearly highlighted the potential to improve the current system. Furthermore, the results of the validation exercise also show that the structure of the CMSM is simple, easy to understandable and is useable by the PMT. The validation results also show that the CMSM creates an opportunity for effective collaboration within the project management team and has the potential to enable the PMT towards effective project cost management and performance outcomes. The next chapter presents a discussion of the research findings in light of existing literature.

CHAPTER SEVEN
DISCUSSION OF FINDINGS

7.1 INTRODUCTION

This research set out with the aim of developing the CMSM for the LcH project delivery by investigating the current CMS employed and identified constraints and implications for improvement. This chapter proceeds to discuss the key findings triangulating, literature, questionnaires and interview findings to answer the research questions and propositions towards an analytical generalisation. The key findings relate to the CMSM concepts and relationship a discussion of themes emerging from the results of the research as presented in previous chapters. Specifically, the chapter provides an important link(s) between chapters 2, 4, 5 and 6.

This chapter is structured as follows

- Discussion on LcH project delivery environment
- Discussion on the relationship between CMS and LcH project cost performances.
- Discussions on current CMS relating to technique, process approach, and IMSF.
- Discussion of technical and implementational improvements in current CMS to enhance effective cost management and performances
- Development and validation of the CMSM

7.2 LOW-COST HOUSING PROJECT DELIVERY

From the qualitative findings, the LcH is one of the intervention strategies government targeted at providing adequate housing for the low to middle-income groups particularly within salary grade 4 to 9. Findings further reveal that LcH projects are residential buildings not exceeding three bedrooms constructed to the predefined basic standard size, quality and minimum aesthetic features, located in the same area or several geographical locations, but implemented under the same project scheme management and contract. This assertion confirms the description was detailed in the NHP with minimum liveability features within the context of its popular usage in Nigeria. These findings confirm arguments by Oladapo 2001, and Ogbu & Adindu, 2012) that there are subtle differences in the concept of LcH and its target groups which may differ between countries reflecting differing national economies. Furthermore, the findings reveal that the LcH project delivery involves four main stages: predesign, design, tender, and award, construction stages. The sequential execution of the stages is influenced by the procurement route adopted. In the case of the Nigerian southeast zone, the participants acknowledged that both traditional and design and build procurement system are commonly adopted confirming previous findings (Idiake et al., 2015; Obi et al., 2015; Dada 2012; Babatunde et al., 2010). This finding also affirms existing literature evidence such as documented by Memon et al., (2014) in a study of MARA projects in Malaysia. This study stated that the project delivery process for LcH projects are similar to other building projects and can adopt both procurement routes.

There are varying views of assessment of a successful project by it key stakeholders. According to Wateridge (1998, cited in Westerveld (2003), project success is expected to align to meet the client project objective and satisfaction. Findings from the qualitative stage indicated that there are four main criteria to measure project success: effective cost performance, time performance, quality performance and end user satisfaction. They clearly highlighted effective cost performances as a critical and prioritised criterion to measure LcH project success. To confirm this finding, the result from the quantitative stage revealed a substantial agreement by respondents. This finding is in agreement with those of other studies (Adinyira, et al., 2012; Ahadzie, et al., 2008). Therefore, effective project cost performances within the target budget is a highly prioritised criterion on low cost housing project delivery in the case study area.

From the review on this concept, akin to previous studies findings (Park, 2009; Assaf et al., 2012; Smith, 2014) effective cost performance is also a critical success criterion to meet client satisfaction in the Nigerian context (Ogu, 1996; Akinde, 2012). Such emphasis would largely emanate from the primary objective to meet housing affordability of projected beneficiaries as promoted by the government. It is also clear that project cost performances have had a significant impact on existing housing situations particularly in both Nigeria and especially the southeast zone (Ogbu & Adindu, 2012). This finding is seen to be consistent with those of other studies (Adinyira, et al., 2012), suggesting that effective cost performances are pivotal to the realisation of successful the LcH provision in many developing countries. The LcH provision is a non-profit driven venture, and in the case where poor project cost is experienced, the impact is transferred to the final supply costs undermining affordability of the projected beneficiaries. Hence, confirms that effective project cost performances are of immeasurable value on LcH project delivery and provision.

7.3 RELATIONSHIP BETWEEN CMS AND COST PERFORMANCES OF LCH PROJECTS

In this regards proposition 1 and 2 were tested and analytical generalisation made.

- *Proposition 1: Ineffective cost management systems employed influences poor LcH project cost performances*
- *Proposition 2: The choice of techniques and process approach employed influences the effective outcome of the CMS*.

7.3.1 Low-cost Housing Poor Cost Performances

Experts acknowledged that achieving effective cost performances are highly prioritised in the LcH project delivery receiving considerable demanding attention. However, a remarkable finding from the study is that many LcH projects have experienced poor cost performances. Several possible explanations could be given for this result. The lack of well-developed and widely used systems for LcH project management in construction literature in Nigeria suggests that appropriate consideration for effective performances is not accorded to the project delivery phase. More particularly is the area of project cost management, which is identified as a pivot for viable LcH project cost performances. Though extensive studies on LcH poor cost performances in Nigeria identifies ineffective CMS as a contributing factor, yet there is petite or no evidence in the literature that suggests these studies have sought to investigate CMS in current use on such projects to proffer appropriate systematic solutions.

The study's results clearly indicate that several benefits accrue from employing effective CMS on the LcH project delivery. Effective cost management, effective cost performances, improved value for money and improved client satisfaction are the specific benefits confirmed from the case study investigated in this context. These corroborate previous findings by Tang, (2005), Kern and Formoso (2006), and Obi and Arif, (2015). Therefore, there is the need for awareness required by project sponsors and managers to bring their attention and commitment to understanding the strategic role of effective cost management systems in improving effective cost performances in LcH project delivery in Nigeria and especially the southeast zone towards successful LcH provision.

7.3.2 Cost Management System Characteristics

This section covers the involvement of the PMT, the techniques and process approach

7.3.2.1 Involvement of PMT in the Cost Management Practice

Furthermore, the case study findings reveal that the CST were mostly involved in the implementation of the CMS in comparison with the level of involvement by the client supervisory team and the contractor's site team. The lack of total involvement based on their comments was traceable to;

- The level of know-how of the HAST and CNT on project cost management
- The sole reliance by the HAST on the expertise of the consultants
- The procurement system employed as in the case of traditional procurement system where the contractor is employed at the construction stage

This is also seen to affect the cumulative gathering of knowledge amongst the PMT needed to choose appropriate and implement effective process approaches.

7.3.2.2 Cost Management Techniques

Regarding this theme, the findings of the case study reveal nine main nine techniques employed in the CMS for the LcH project delivery. Out of these nine, five are predominant. These include cost estimating, on-site resource control, cash flow forecasting, site meetings, and cost reporting. Although the TC and EVA were identified as effective techniques, they were rarely employed in the CMS to manage project cost. According to the case study findings, the project target cost is estimated ad set after designs are completed through the cost estimating process.

Cash flow analysis and performance review from site meetings are the popular techniques used to monitor cost during construction. These cost monitoring and control techniques employ simple variance analysis that did not relate to any current performance trend to forecast future performance. These limitations posed some difficulty particularly at the setting and monitoring and control process stages affecting the outcome at these stages of the CMS process.

7.3.2.3 Cost Management Process

Furthermore, this choice of techniques influenced the process approach employed within the setting, planning and estimating budgeting, monitoring, and control process stages. Though literature findings of this research show that cost-design-control implementation approach is most effective towards achieving improved value for money (Section 2), the case study findings identified design-cost-control process approach as popularly used in the CMS employed LcH projects in the Nigerian southeast zone. It was further found that its predominance adoption in the CMS is influenced by choice of techniques employed at the various process stages by the PMT. However, respondents acknowledged that the cost-design-control approach could be a more effective approach to adopt.

Based on the case study findings the techniques and process approach employed in the CMS characterises it as a conventional system. This finding affirms that the PMT predominantly employ conventional CMS in LcH project delivery in the Nigerian southeast zone CMS (Section 5.4.2). This finding substantiates finding reported by Obi and Arif (2015), Chigara et al. (2013) and Iroegbu et al. (2010) on the dominance of conventional CMS in the delivery of many building projects in Nigeria and many developing countries of the African region. However, findings emerge from further investigation on the predominant use of conventional CMS. These include:

- the resistance to change by members of the PMT to embrace modern techniques,
- familiarity with conventional techniques,
- the lack of implementation procedure for some of the modern techniques as seen in the case of TC,
- lack of full involvement of the PMT members in the cost management process,
- the level of knowledge of cost management by PMT members,

- lack of effective team collaboration which limits the share of ideas and
- level of awareness of modern more effective techniques appropriate for certain cost management process stages.

These limitations are seen to affect the effective outcome of the CMS on cost performances.

Further findings of this study reveal that the PMT acknowledged that the use of the conventional CMS is its advantage to assist in effective cost estimates, preparation of Bills of quantities, budget baseline and financial reporting for the projects. However, they confirmed a number of disadvantages. These disadvantages include the inability to determine or set project target cost for the project before design, difficulty to effectively plan and allocate elemental cost targets within allowed budget, construction waste resulting from the excessive level of variations on the project affecting cost control. The constraints of the system they acknowledged have led to the poor cost performances of the LcH projects. These findings are in agreement with previous findings by Kern and Formoso, (2006), and Hanid et al. (2011) that conventional CMS are ineffective to deliver expected cost performances. It further confirms their critique the conventional CMS provide reactive management assist rather than proactive needed to meet and surpass client expectation in the contemporary practice of cost management (Section 2.7).

Based on this discovery, and recommendations by recent research emphasise the use of modern CMS from the early project stages to effective cost management and performances there is the need for PMT to adopt CMS able to provide proactive management support to achieve both effective cost management and performance outcomes.

7.4 IMPLEMENTATION SUCCESS FACTORS

In this regards proposition 4 was tested and analytical generalisation made.

- *Proposition 4: Certain success factors are pivotal to maintain effective and viable implementation within the CMS for the LcH project delivery in Nigeria and especially the southeast zone.*

In reviewing the literature, only a few authors have identified the factors and associated drivers affecting CMS implementation (Section 2.9). Therefore, this study has attempted to identify the key drivers needed for effective implementation within the CMS and succeeded in grouping them into factors. To refine the factors, an initial review of the drivers associated with project management and cost performances helped to identify 13 potential drivers (Section 2.9). The salient feature of the identified drivers is that each of them was consensually identified across the many kinds of literature reviewed. In the process of identifying the success drivers, one of the important findings in this study is the failure drivers that affect the regulation of techniques and process approach within the CMS (Section 4.6.1).

According to the qualitative findings (Section 4.4.3), 17 barriers emerged affecting effective techniques and process implementation. These barriers include;

- The lack of commitment to project objective,
- Poor project planning
- incompetent project team members and professionals,
- The poor knowledge of project cost management,
- The lack of available cost data
- The poor collaboration of the design team
- Government agencies bureaucratic delays in approvals,
- Government agencies bureaucratic delays in funding and approvals,
- Poor site supervision and management
- Variations and design changes,
- Errors in estimates and drawings,
- Community restiveness
- Burglary,
- Inclement weather,
- Unstable economic and
- Unstable political environment, and
- Unclear client project brief.

These barriers were also found in previous studies (Olawale &Sun, 2010; Tang, 2005) who that noted that these barriers need to be mitigated for effective implementation in the CMS (Section.2.6).

Subsequently, qualitative findings from the interviews (4.5) recommend 13 drivers to improve CMS implementation in LcH project delivery. These drivers include clear and well-defined client project brief, effective cash flow, availability of cost data, competent design team professionals, competent contractor management team, effective collaboration, well-detailed design and specifications, adequate land compensation to communities, stable weather conditions, and stable political and economic environment. Some of the drivers identified corroborate literature findings (2.9) however, constructability and effective risk management were not considered contextual in CMS implementation in LcH project delivery. Besides, participants integrated budget update into effective project planning and supervision confirming 13 drivers. The drivers were subjected to FA, and one driver availability of cost data was eliminated in the rotation process retaining only 12 drivers. Based on contextual relationship FA rotated, the 12 drivers into three factors and g their characteristics named effective team qualities, effective information and management actions, and a stable operational environment. However, the FA did not determine the level of importance of each driver and their relationship in the system. Neither did it show the driver relationship with performance pointers. Therefore there was a need for further analysis using the ISM and IRP. The 12 drivers were subject to further analysis in the ISM and IRP to ascertain their contextual relationship with each other and with the performance pointers of the cost management process. Results from the ISM revealed that nine drivers have a high influence on the system. However did not show their influence on the performance pointer of the cost management process. Therefore the IRP was subsequently employed to achieve this purpose (6.5.2). The IRP proceeds to rank the nine drivers with aching each performance pointer of the cost management process (6.5.3).

The three IMSF and are their associated drivers are discussed below:

7.4.1 Effective Team Qualities

An effective team quality is a key success factor in CMS implementation. This factor requires a competent design team and contractor, early contractor involvement who effectively collaborate to ensure the strategic decisions that can affect the choice of techniques and process approach implemented in the CMS. It is a human related success factor also highlighted in past studies by Mishra et al., (2009), Song et al., (2009), Amade et al. (2015) and Okoye et al. (2015). They all identified this factors as most influential on management performances which this study further confirms. It drivers are discussed as follows:

7.4.1.1 Competent design team and competent contractor team.

Competence refers to the degree of skill, knowledge, and experience of team members that they possess as espoused and (APM, 2015; Alexandrova &Ivanova, 2012) guides their input in the CMS implementation. The results of Section 4.5.4, 6.52 and 6.5.3 suggest that these two drivers are highly important drivers that can lead to effective implementation of the CMS. These drivers are identified as significant influential independent drivers that positively facilitate other seven drivers in the system. The result of the IRP confirms that these drivers dominate the four performance pointers of the CMS process. This finding shows their significance on implementing the techniques and process stage to achieve the performance pointers. Hence, the PMT engaged need to be knowledgeable, professionally qualified and have relevant experience in their roles in the cost management practice. These qualities are needed because their competency influences their input in effective implementation of the CMS.

7.4.1.2 Early contractor involvement:

The results of section 4.5.4, 6.52 and 6.5.3 confirm that this driver is highly important and can lead to effective implementation of the CMS. Previous findings by International Association of Dredging Companies (IADC, 2011; Sinclair, et al, 2002) acknowledged that early contractor involvement facilitates relevant information on building costs feedback from actual projects based on tacit knowledge of the PMT. This early involvement provides a collection of knowledge and experience necessary to enhance strategic decisions early in the project life that can affect the project planning, designing, and control in a cost-effective manner. Furthermore, collaboration fosters better cooperation between the contractor and the project management team throughout the predesign, design, and construction process to plan effectively, and estimate and budget costs to deliver the best value to the client (Song, et al., 2009). Therefore, this driver from the ISM result is a significant influential independent driver positively facilitates other drivers in the system. From the IRP results, it dominates three performance pointers associated with the setting, the planning, and the estimating and the budgeting process stages. This finding confirms that this driver is important to achieve effective CMS implementation and project sponsors need to seek avenues to ensure that the contractor is engaged early on LcH project delivery.

7.4.1.3 Effective team collaboration and commitment

The results of sections 4.5.4, 6.52 and 6.5.3 suggest that this driver is a highly important driver that can lead to effective implementation within the CMS. This finding confirms previous findings by Song, et al. (2009) that effective collaboration fosters better cooperation between the contractor and the other project management team throughout the CMS process to effectively plan, estimate and budget costs to deliver the best value to the client. Collaboration, which embodies coordination and trust, is needed for interactive teamwork and two-way communication to share knowledge and effectively manage strategies to solving both individual and project focused tasks during the cost management process (Mishra &Mishra, 2009). The result of the ISM confirmed this driver as significant and influential positively facilitating other drivers in the system. The IRP results also confirm that this driver dominates four key performance pointers associated with the setting, planning, estimating, and budgeting stages. These findings make the driver an important driver included in the CMSM.

7.4.2 Effective Information and Management Actions

The second influential factor in CMS implementation is effective information and management actions. This factor is a management related success factor as supported by findings in past studies by Shrestha and Mani (2013) and Amade et al. (2015) ranking as highly significant. However, in this study, it is the second influential IMSF. The drivers of this factor include; detailed Project designs and specifications, Clear and well-developed client project brief, Effective project planning, and Supervision. Therefore is needed for improved CMS.

7.4.2.1 Adequate designs and specification:

The results of Section 4.5.4 suggest that adequate design and specification as a highly important driver and section 6.52 and 6.5.3 confirms that it can lead to effective implementation within the CMS influence. Also, section 6.5.3 confirms that this driver has a significant impact in the monitoring and controlling project cost. This finding aligns with Shrestha and Mani (2013) in that the adequacy of designs and specifications is critical for project control cost. Furthermore, given that public projects such as LcH are funded from taxes, it is necessary that the government complete the projects within a reasonable cost, adequate design and specifications will facilitate essential feedback into the CMS. This feedback is particularly needed to produce accurate cost estimates during the planning and estimating process as well as project planning and supervision during the monitoring and control stage. Therefore is is needed for improved CMS.

7.4.2.2 Effective project planning and site supervision

The results of Section 4.5.4 suggest that effective project planning and supervision as a highly important driver and section 6.52 and 6.5.3 confirms that it can lead to effective implementation within the CMS. This finding aligns with Tan and Ghazali (2011) and Haughey (2014) who espoused that this driver facilitates effective coordination and integration of project activities. It also enables the team to clearly program and document deliverables, schedule, monitor real-time, and produce cost scale as well as effective project site resources control (Haughey, 2014). Findings of the study confirm that this driver is an important dependent driver with significant impact on the budgeting and control stage to achieve effective operational cost baseline and performance index analysis. Therefore is needed for improved CMS.

7.4.2.3 Clear and well-detailed Client Project Brief

The results of Section 4.5.4 suggest that a clear and well-detailed client project brief is a highly important driver and section 6.5.2 and 6.5.3 confirms that can lead to effective implementation within the CMS. This finding aligns with the report by (APM, 2015) that a clear client project brief defines the strategic project outcomes of the project in terms of purpose, the set objectives, and the requirements necessary to guide the project management team from predesign through construction with effective management of costs on the project. Results in 6.5.3, confirms that this driver is particularly important during the setting and planning estimating process stages as it will facilitate effective determination of the project target cost, development of cost-effective designs and elemental cost target. Therefore is needed for improved CMS.

7.4.3 Stable operational environment

This factor is of least influence on CMS implementation in LcH project delivery in Nigeria. This result implies that focus on this factor by the PMT on it should be relatively minimal. However, its impact cannot be ignored. Its key drivers are adequate and effective cash flow and adequate resolution of land compensation issues as key drivers. This finding corroborates previous findings by Olawale et al., (2010), Arcilia, (2012) and Akanni et al., (2015) that project environment related success factors have the least influence on CMS performances. Though sections 4.5.4 suggest that stable economic and political environment and weather conditions are important drivers, the results in Section 6 .5.2 and 6.5.3 confirm them less important for CMS implementation. This finding agrees with those by Akanni et al. (2015) that the project environment in Nigeria presents particular difficulties where land compensation issues can have more impact on project outcomes than economic, political and weather conditions. Therefore, stable economic and political environment and weather conditions were not considered influential to improving the CMS. The subsequent sections discuss the two key drivers of this factor.

7.4.3.1 Adequate and effective Cash Flow

The results of Section 4.5.4, suggest that adequate and effective cash flow is an important driver that can lead to effective implementation within the CMS. Similarly, the results in Section 6, further reports that this driver is dependent on the influence of other drivers to function in the CMS effectively. The results of the IRP confirms it has a considerable level of impact on the control process stage. This finding aligns with findings by Usman et al. (2016) that effective cash flow is vital to successful project delivery. It is, therefore, one is one of the key client's obligations (Saisi, et al., 2015) on LcH project delivery to assist the PMT, mainly the contractor, maintain workflow necessary for effective project cost control.

7.4.3.2 Adequate resolution of land compensation issues

This is one of the emergent findings from this study. The results of Section 4.5.4, suggest that this driver is important and can lead to effective implementation within the CMS. Similarly, the results in Section 6, confirms that it has a considerable level of impact on the control process stage. Though the PMT can provide useful recommendations that can assist the project sponsors in strategic decisions, their control on this driver is minimal. Therefore, appropriate procedures to ensure adequate land resolution is in place to mitigate problems that can lead to project delay and vandalism that affect cost control

7.5 IMPROVEMENT MEASURES IN CURRENT CMS

- *Proposition 3: The current CMS need both technical and implementational improvement for effective outcomes.*

The results of this research highlight both technical and implementation improvement measures. For the technical improvement measures, integration of additional techniques; Target costing and EVA and the adoption of cost- design- control approach have been proposed. The critical consideration of three key success factors to maintain effective and viable implementation within the CMS in the LcH project delivery have been highlighted. Some of the specific improvement measures reported in this research have been reverberated in the work of other researchers though in different contexts (Section 2.7 and 2.8).

7.5.1 Integration of Additional Techniques- Target Costing and Earn Value Analysis

This research has identified from literature a number of effective techniques that can improve CMS outcomes (Section 2.7.3). The TC and EVA are two of such techniques. There was a consensus in the literature that Target costing would be appropriate for setting target project cost, facilitating effective elemental cost targets, and the EVA for real-time monitoring and performance assessment towards proactive cost control (Section 3.2.3). The interviewees also strongly suggested the adoption of TC and EVA in the CMS to improve system performance (Section 5.7) which was subsequently confirmed by the questionnaire respondents. These findings clearly show that the integration of the TC and EVA in the current system can enhance positive improvement.

7.5.1.1 Target Costing Technique

The target costing technique was identified as appropriate for the setting and planning process stage to effectively determine the target cost and establishing effective elemental cost target. This technique requires establishing the target price based on market prices and what is affordable by the end-users or how much the housing agency as set as sale price target. The profit margin set by the agency is deducted from the target price to determine the cost at which the project must be achieved. After that calculating the probable cost of current products and processes and seeking effective avenues to reduce cost towards achieving the target cost will be undertaken by all the efforts of the PMT. This finding is in agreement with studies by Hanid et al. (2011) and particularly Jacomit and Granja (2011), and Kern and Formoso (2006) who identified this technique as effective to set and plan project cost at the predesign and design stages of the LcH project delivery. However, following the case study qualitative findings, it was identified that the implementation of the TC did not fully incorporate the contractor or the client set consultant team as the target cost. This procedure can be seen as inappropriate as a Target costing technique, as it requires collaborative involvement by all team members with managerial influence on project costs such as the contractor, client consultants, and even suppliers need to be involved from the early stages of the project. This lack of full involvement of the PMT members could be seen as one of the areas affecting its effective implementation.

Whereas their view of target costing as an appropriate technique cannot be denied, the implementation of the TC on construction related projects have evolved over the years and a more advance procedure TVD is being advocated. The TVD technique is employed during the setting and the planning and estimating stage to determine effective project target cost and elemental cost target. As documented in studies by Zimina et al. (2012) and Ballard (2012), the appropriateness of the TVD at these stages is highly encouraged to eliminate potential waste that can affect project cost management and performances from the early stages. However, there is little evidence available in the literature on the application of TVD at the monitoring and controlling stages. A possible explanation for this might be that various models have only been successful to demonstrate the effectiveness of the TVD at the setting and planning and estimating stages that are associated with the predesign and design stages of project delivery. Therefore, further studies in developing TVD implementation model for the LcH projects in Nigeria is an area for future research.

7.5.1.2 Earn Value Analysis (EVA)

The second identified technique for integration is the EVA. The EVA is considered effective for project cost control because it identifies variances by real-time monitoring of actual project performance against cost estimates without taking into considerations cost projections. This research confirms this finding (section 4.6.1 and 5.5.4). The EVA has been identified as an effective project cost controlling technique at the project construction stage of various construction projects. Ballard (2002) proffered technique for project cost control called the Last Planner. However, the EVA is a validated technique tested on many public sector projects such as LcH that has improve management results. For example, in the USA, integrating EVA as a cost-controlling technique is a requirement that contractors and sub-contractors working on defence construction projects (Reiss, 1992). Following its profound level of effectiveness to cost projection and control, the EVA technique is becoming a popular choice for project cost control. However, it is yet to gain more grounds in use across building and housing projects in developing countries.

One of the key findings of the study detailed in Sections 4.7 and 5.7 is the constraints of the CMS not able to provide effective real-time cost monitoring during construction. For technical improvement, the EVA is recommended (section 5.7.1) corroborating literature findings (Section 2.7). The integration of the EVA supports the idea for improved cost control practices. It is essential to employ such effective techniques (Humphreys& Associates 2014; Chigara et al., 2013; Czernigowska, 2008; Gupta, 2014). However, the EVA cannot be used in isolation during the monitoring and control process stage but alongside other effective techniques currently employed during the control process stage. The EVA can support monitoring and forecasting that provide early warning of potential problems, identify problem areas for proactive management attention, improve project visibility and accountability and enable accurate cost reporting which are necessary input for effective project cost control during construction. The results provide feedback for cash flow analysis and onsite resource control during construction. The EVA technique is integrated into the CMSM for improved system performances.

7.5.2 Integration of Implementation Success Factors

Three IMSF is considered important for effective implementation of the CMS namely, effective team qualities, effective information and management actions and stable operational environments. Findings from Sections 6 confirm that these factors and its associated drivers (section 7.4) are needed to implement the techniques effectively and to achieve the four performance pointers in the cost management process.

An effective team quality is a fundamental factor key for effective CMS implementation. In this context of improving the performance of the CMS on the LcH project, is one of the viable strategy to improve LcH provision in the zone. The qualities and capability of the PMT determine the quality of knowledge, experience, and collaboration in the cost management process. These qualities are needed for strategic decisions at appropriate stages of the cost management process. This finding agrees with the views from a previous study by Okoye et al. (2015), Amade et al. (2015), Mishra et al. (2009), and Palmer (2014). They all in their studies highlighted that without the right team in place, implementing any strategy or plan has the potential of completely falling apart. Therefore, the importance of this factor being integrated into the CMS cannot be underrated as it is needed to improve project cost management and performances of LcH projects in the Nigeria.

The second important factor is effective information and management actions. Findings from Sections 4.5, 5.4 and 6.5.2 reveal that effective information and management actions is the second most important factor needed for effective implementation within the CMS. This factor possesses three influential drivers: detailed project designs and specifications, clear and well-developed client project brief, effective project planning and supervision (Section 6.5.2). A clear client project brief leads to preparation of adequate and detailed designs and specifications needed for effective project planning and supervision during the cost management process. The clear client brief identifies what the requirements for the project are regarding cost and value. The brief guides the PMT to develop adequate and detailed designs and specifications leading to effective cost targets for each element of the building. With the cost targets effective planning and supervision of project activities and. Onsite resource control during construction can be undertaken, and therefore, helps in monitoring real time progress, report, and documented deliverables, and produce the cost scale performance report. These findings support findings by Olawale and Sun (2010), Shrestha and Mani (2013) on the impact of quality designs and specifications on effective management implementation, Amade et al. (2015) on effective project planning is highly fundamental for successful public sector project management in the Nigerian southeast zone. Therefore, this factor is confirmed significant to improve CMS implementation in LcH project delivery in the Nigerian southeast zone.

The third factor needed for effective and viable implementation in the CMS is a stable operational environment. This success factor is seen as the least important; however, it cannot be ignored. This finding corroborates previous findings by Akanni et al. (2015), Arcilia (2012), and Olawale et al. (2010) that project environment related factors have the least impact on project cost management. Findings from Section 4.5.4 and 6.5 reveal that though this success factor possesses five drivers, only two are considered influential drivers needed for effective implementation: adequate and effective cash flow and adequate resolution of land compensation issues. This support finding by Akanni et al. (2015), that though the project environment in Nigeria operational project environment presents special challenges, only land compensation issues do have considerable impact. Therefore, appropriate procedures to ensure adequate land resolution and adequate project financing and negotiating mechanism need to be put in place by project sponsors as these drivers are beyond the control of the PMT. This is necessary to create a stable operational environment that will facilitate effective implementation within the CMS towards achieving effective cost management and performances in LcH project delivery in Nigeria and especially the southeast zone.

7.6 CMSM DEVELOPMENT AND VALIDATION

- *Proposition 5: A comprehensive CMS model can improve LcH project cost management and performances in Nigeria and especially the southeast zone.*
- *Proposition 6: The CMSM can assist project management teams to achieve effective cost management and performances in LcH project delivery in Nigeria and especially the southeast zone.*

Effective cost performances of LcH projects have been identified to have the potential to improve the LcH provision towards successful realisation of future schemes. Nevertheless, employing an effective CMS is a viable strategy to attain improved cost such performances. This study have identified the key issues affecting current CMS for LcH project delivery in Nigeria based on a case study of the Nigerian southeast zone. It further develops the CMSM which details both structural and operational mechanisms that have the potential to enhance how project cost can be managed for effective performances. The CMSM was designed and developed using the IPO, IRP and ISM techniques to model the key findings from the research. The validation results indicate that the CMSM is simplistic and has a clear structure that highlights specific components needed to achieve effective management and performances. Thus, it enables the users to view and understand the relationship between the various components and subsystem of the model (Section 6.5).

The CMSM highlights four areas of the CMS: techniques, process, control, and outcomes subsystem. This study finding revealed the need to improve the technical, process and control integrating appropriate measures. These improvement measures have emerged from the findings of the case study and validation process. The validation results indicate that the CMSM when employed has the capability to assist the project management team in achieving effective project cost management and cost performances in low-cost housing project delivery in the Nigerian southeast zone. This is because the CMSM operational guide aligns the cost management process with the project delivery stages (NIA/ARCOM) providing simple and easier understanding for the PMT to implement. Besides, the results confirm that the CMSM could be widely applicable and relevant for current cost management practices on LcH projects in the southeast zone and across Nigeria. This analytical generalisation is given similar contextual characteristics of LcH project delivery across the country. Therefore, its adoption should be client- demanded providing favourable environments as implementing the CMSM is a collective effort of the PMT from the project start to finish.

7.7 CHAPTER SUMMARY

This chapter has presented a discussion of the emerging findings based on the various concepts investigated. The chapter has given an insight of the findings into the current CMS practice on the LcH project delivery. Furthermore, the chapter has discussed the results that emerged regarding the relationship within the CMS and between the CMS and Cost performance and how it informed the CMSM development. The discussion reveals that current CMS employed on the LcH projects are reported to focus greatly on conventional CMS employing conventional techniques and implementation approaches despite well-voiced advantages of integrating modern techniques.

It discussed and reported that the conventional CMS is dominant in the LcH project delivery in Nigeria especially the southeast zone. This system has had a strong influence on the poor cost performances experienced on such projects. The chapter also highlighted three key areas for improvement (techniques, process, and implementation). The current CMS requires integrating modern techniques and the cost-design-control approach and three important IMSF for improved outcomes. These improvements will allow the PMT to manage project costs, proactively particularly given areas of difficulties currently experienced in the setting, planning, estimating, and control process stages.

Finally, the design and development of the CMSM have been discussed considering the design methodology, structure, contents, and operational guide. The next chapter presents the conclusions of the study and its recommendations.

CHAPTER EIGHT
CONCLUSIONS AND RECOMMENDATIONS

8.1 INTRODUCTION

The aim of this research is to develop a CMS model for achieving effective cost management and performances in LcH project delivery in Nigeria and especially the southeast zone. Preceding chapters have documented the empirical findings while this current chapter proceeds to summarise how the research aim has been achieved through the stated objectives. It makes relevant recommendations as well as areas for future research. This chapter is structured in the following order:

- Research conclusions
- Revisit the research aim and objectives,
- Key contributions of this research
- Limitations
- Key recommendations from the study

8.2 RESEARCH CONCLUSIONS

Poor project cost performances are one of the vital issues challenging successful delivery of Low-cost housing (LcH) projects in Nigeria. The research discovered that though there are extensive studies relating to cost performances many have failed to carry out an actual contextual investigation into reasons why the CMS is unable to deliver expected performance outcomes on these projects. Furthermore, no significant attempt has been made to develop and proffer an appropriate CMS model that can assist the PMT in implementing effective cost management particularly for LcH project delivery in Nigeria and especially the southeast zone. Therefore, this study set out to investigate the characteristics and efficacy of current CMS in use for LcH project delivery in the Nigeria using a case study of the southeast zone. This investigation is needed to conceptualise, develop, and validate an appropriate system model for managing costs on the LcH projects towards effective cost performances. Based on the findings of this research the study concludes that:

- There is a relationship between CMS and LcH project cost performances in the Nigeria and especially the in southeast zone.
- Ineffective CMS employed is a significant factor contributing to poor cost performances experienced on LcH projects delivered in Nigeria and especially the in southeast zone.
- Conventional system are popularly employed to manage costs in LcH project delivery in Nigeria and especially the in southeast zone
- The current CMS employed are ineffective to deliver expected performance outcomes particularly effective cost performances of LcH projects in Nigeria and especially the in southeast zone.
- The current CMS employed are constrained by:
    - ✓ lack of appropriate and effective techniques required to effectively set, plan and monitor project cost management in the CMS process
    - ✓ Reactive process approach- design-cost-control process
    - ✓ 14 implementation barriers in the CMS
- Improving the current CMS for the LcH project delivery in Nigeria and especially the in the southeast zone will require the:
    - ✓ Integration of TC and EVA in the technical subsystem of the CMS
    - ✓ Adoption of the cost-design-control process approach
    - ✓ Consideration of three key IMSF. These include; effective team qualities, effective information and management actions, and a stable operational environment.

- This improved CMS, can be considered a modern CMS following its proactive managerial characteristics. Hence, can meet contemporary cost management practice in LcH project delivery towards improved performances.
- The improved CMS captured in the CMSM is considered appropriate for LcH project delivery in Nigeria and especially the in southeast zone.
- Following validation results, the proposed CMSM is capable of assisting the PMT to achieve improved cost management and performances of LcH projects in Nigeria and especially the in southeast zone.

8.3 REVISITING THE RESEARCH AIM AND OBJECTIVES

The aim of the research was to develop a CMSM for LcH project delivery in Nigeria. The objectives to realise this aim include:

- Critically review the concepts and characteristics of the LcH project delivery, CMS, and IMSF.
- Identify the characteristics of the cost management system(s) employed in LcH project delivery in Nigeria.
- Evaluate the efficacy of the current project cost management system(s) employed on cost performances of LcH projects in Nigeria.
- Identity the most suitable techniques, process approach, and key implementation success factors that can potentially improve the efficacy of the CMS for the LcH project delivery in Nigeria.
- Conceptualise and validate a system model for improved cost management and performances in LcH project delivery in Nigeria.

The fulfilment of each objective is presented in the subsequent sections.

8.3.1 The Concept and Characteristics of LcH Project Delivery, CMS and IMSF

The researcher depended on a review of relevant literature to grasp an understanding of the concepts in order to fulfil the first objective. In this regards, the researcher conducted a comprehensive review of literature into the concept of the low-cost housing provision system, LcH project delivery, and project cost performances to identify the trajectory trends, key success criteria, and challenges, particularly in the context of the Nigerian southeast zone (Chapter 2). The review of the project cost management system and implementation success factors were also conducted.

It was discovered from the findings from literature that the usage of the term LcH from the perspectives is:

- An intervention strategy to meet housing needs of a certain population group.
- Appropriate technology advancement strategy.

However, the perspective of LcH as a government/ public- sector intervention strategy to meet the housing needs of certain income groups, particularly those within the low and middle incomes who without assistance cannot afford adequate housing at prevailing market rates have been well voiced and documented in literature. Various scholars have described such housing by liveability features, income group classification, or both. However, they all appear to have a common understanding that this housing, is targeted at the Low and middle-income groups and is not presumed to have a universal definition, as meanings may differ within a country, between countries and continents reflecting differing national economies (Oladapo, 2001; Ogbu &Adindu, 2012). Discussion on LcH has identified its nature, need and provision trend. The associated challenges facing its provision and project delivery have also been espoused by various scholars across the globe and particularly, in Nigeria as a developing country. As part of achieving the first research objective that is also concerned with examining this concept in the setting of the Nigeria, there was a need to identify the provision trend, project delivery, and associated challenges. Studies and reports on the trend of LcH provision since its evolution as far back as 1960s in Nigeria, show that many LcH schemes have recorded minimal success, and both in the case of the southeast zone. Some of the challenges identified are traceable to the project delivery phase of the provision (the framework for provision covers policy initiation, land and finance acquisition, project delivery, allocation, and subsequent maintenance stages.

Furthermore, the concept of the LcH provision has been extensively discussed. However, only a very few studies have investigated the area of the LcH project delivery and project cost performances. Based on the investigations of previous studies on the LcH project delivery, it is observed that the importance of the outcomes of the project delivery phase on the successful provision process cannot be underrated. In fact, it is observed to have a significant impact on housing situations. The LcH project delivery phase of provision involves four key stages (Pre-design, design, tendering, documentation, and construction) in which project resources are utilised to produce LcH units.

However, the literature findings show that the success of the LcH project is measured by attainment of certain performance criteria that meet the satisfaction of the public sector client. One of the key criterion identified was effective project cost performances. An effective project cost performance is a performance of the project within set budget without quality compromise and the satisfaction of client. Unfortunately, various scholars have lamented over the trend of poor cost performances associated with many of such projects. Such is the case on LcH project cost performances in the Nigerian southeast zone, where it is described as a significant factor contributing to current poor housing situations. Findings from literature revealed that poor cost performances of the LcH projects in the Nigerian southeast zone mainly:

- Affect satisfaction of the public sector clients who end up spending more on the project
- Lead to abandonment or delay in the project completion in the case where client is not willing to spend more than budgeted
- Result in low production housing output
- Lead to high final sale prices of the houses above that initially advertised
- Undermine affordability to target beneficiaries

Having identified the importance of effective cost performances in LcH project delivery, various scholars have advocated for the adoption of effective strategies during delivery. It is proposed that such will lead to improvement in the supply side of the LcH across Nigeria and especially in the southeast zone. While some of the studies suggest the adoption of technological strategies, such as cheaper construction technology systems or building materials to aid cost reduction, others have advocated for proactive managerial avenues that can facilitate cost reduction and improved project cost performances. Regarding the latter, Akinde (2012), Okoye et al. (2015), and Obi and Arif, (2015) maintain that improvement of cost performances can be achieved via effective management strategies or systems.

On the concept of CMS, the literature shows that it is a pivot for achieving effective project cost management and performances. Two main categories of CMS; conventional and modern are highlighted in literature with the later identified as more effective to achieve effective cost performances. The classification of the type of CMS employed is dependent on the choice of techniques modern or conventional techniques, process approach, (reactive or proactive) and nature of management support. The CMS comprises mainly of techniques and processes. However, the literature clearly highlights the need for consideration of certain factors to aid successful implementation of the techniques and process. This study termed these factors-IMSF. The techniques are seen as input, and the findings from the literature review assisted in identifying ten common cost management techniques. The process is viewed as the transformation circuit where the eventual outcome of the system is decided. Four main process stages implemented via two main approaches; design-cost-control and cost-design-control are identified The design- cost- control approach is seen as a reactive management approach and the other a proactive management process approach and findings from literature advocate for the adoption of the latter. On the concept of the IMSF, the literature findings reveal rare studies in the context of CMS implementation. However, tangential studies identify five main factors. These are the team, project, procurement, management action and project environment related factors. An examination of the findings of these studies highlighted 13 drivers associated with the factors. These drivers found to be in consensus across the studies became a guide for further investigations at the later stages of the research.

Based on the results and findings of the case study, objective one of the research was achieved.

8.3.2 Characteristics CMS Employed in LcH Project delivery in Nigeria based on a case study of the Southeast Zone.

The importance of this second objective is to explore the project cost management system(s) employed in the LcH project delivery in the Nigerian southeast zone and identify its inherent characteristics. The findings of the semi-structured interviews and questionnaires were used to address this objective. It was found that:

- Nine techniques are currently being employed in the CMS five of which are predominant are cost estimating, site meetings, cash flow analysis, cost reporting, and onsite resource control. Site meetings as a technique was one of the emergent findings under this theme.
- Both cost-design-control and design-cost-control process approaches are employed, but the latter is most predominant. The design-cost-control approach was described a reactive management approach which agrees with extant literature.
- The current CMS employed lack proper consideration and integration of IMSF.
- The conventional systems are more popular in use in LcH project cost management in the zone. This finding emerges following is the choice of techniques and process approach employed:

The CMS popularly used in characterised by conventional techniques and a reactive management approach. It also lacks a proactive implementational procedure in the system. Based on the results and findings of this research, the conclusion is that the conventional CMS are popularly used in LcH project delivery in Nigeria and especially the southeast zone. The objective two of the research is achieved.

8.3.3 Efficacy of CMS on LcH Project Cost Performances

The literature has maintained the need for the proper investigation of the CMS employed on the LcH projects in Nigeria and especially the southeast zone. Such investigation requires considerations on the level of effective and appropriate use of the techniques, process approach and IMSF. Before field investigations, findings from the literature review showed a relationship between CMS and project cost performances. However, the level of influence of CMS on LcH project cost performances was not evident. Therefore, further investigations of this relationship within the context of the LcH project delivery in the Nigeria using a case study of the southeast zone were conducted. The research employed semi- structured interviews and a questionnaire survey. Findings from the stage two of the research process revealed that the current CMS employed has a significant level of influence on the project cost performances. In other words, the CMS contributed to poor cost performances of the LcH projects. It was established from the findings that the current system ineffectiveness was due to the inherent:

- Difficulty in establishing effective target project cost before the design
- Difficulty to effectively establish plan elemental cost targets resulting in variations during construction
- Difficulty in real time monitoring of performances and effective budget update on the project that assists in proactive cost control during construction
- These constraints were traceable to both the technical and control areas of the CMS.
    - ✓ Technical constraints identified the lack of an effective technique for setting project cost as well as monitoring real-time cost performances. This clearly indicated the use of insufficient and inappropriate choice of techniques and process approach.
    - ✓ Control constraint identified 14 barriers affecting the effective use of the techniques and process implementation.

These findings achieved objective two and tested proposition one, two and three.

This research objective confirms that that there is a relationship between CMS and LcH project cost performances, which indicates that the effectiveness of the CMS will significantly determine the effective cost performances of LcH projects in Nigeria and especially the southeast zone. Based on the findings from the case study, the CMS employed is ineffective to achieve effective cost performances of LcH projects. This ineffectiveness results from the characteristics of CMS (the choice of techniques and process approach and lack of IMSF).

8.3.4 Improving the Efficacy of Current Cost Management Systems in Use

Objective four was achieved by identifying the most suitable techniques, process approach, and key IMSF for possible improvements of the efficacy of the CMS for the LcH project delivery in Nigeria and especially the southeast zone. Findings from the literature review show the key performance pointers of the CMS process indicating a potential effective outcome from the CMS. To realise the performance pointers literature some appropriate techniques. Two of these techniques and a proactive management process approach were validated contextually applicable through, the findings of the case study and model validation process:

- Technical subsystem: integrating the TC technique to mitigate difficulty in determining project target cost before designs and effective elemental cost budget. The EVA technique to improve real-time cost monitoring and control.
- Process subsystem: employing the cost-design-control process approach for proactive management in a sequence- set, plan, estimate, budget, monitor and control.

In addition, the consideration of three IMSF are key for effective implementation of the techniques and process of the system. Literature findings identify management and team related factors most important. This finding was corroborated in this research context. Findings of the case study and model development and validation process assisted in the contextual identification, prioritisation, and validation of the IMSF to improve the CMS efficacy. The three factors identified are:

- effective team qualities
- effective information and management actions
- stable operational environment

These findings achieved objective three and tested proposition four. This research objective confirms that there is a relationship between the IMSF and the CMS process stage implementation. This concludes that the effective implementation at the process stages is not just achievable with the use of appropriate techniques alone but also IMSF moderation and regulation. Therefore, the integration of TC, EVA, cost-design-control approach and IMSF will improve the efficacy of CMS to achieve effective cost performances of LcH project delivery in Nigeria and especially the southeast zone. Based on this discovery, the next objective conceptualises and validates the CMSM.

8.3.5 Conceptualisation and Validation of the CMSM

This last objective sets out to conceptualise and validate a system model that can assist PMT effectively manage project costs and improve LcH projects cost performances in Nigeria and especially the southeast zone. The CMSM was developed and validated following the steps as depicted by the researcher in Section 6 of this report. The CMSM is structured in such a way to guide the intended users diagnosing the techniques (including the improvement techniques), the process implementation stage highlighting appropriate technique and performance indicator at each process stage, and the IMSF needed for proactive regulation and feedback within the system.

The CMSM components emerged from the literature and case study findings. Its design portrays the interrelationship within and between the subsystems. The model development process requires that the intender users of the model can ascertain its practicability and usability in real context. The concept of IPO process and procedures of the ISM and IRP modelling techniques made the CMSM design more simplistic for better understanding and usability. Expert validation also facilitated the achievement of the CMSM development and validation. The validation process was used to ascertain the structure, clarity, simplicity, usability, and appropriateness of the model to assist PMT achieve effective cost management and other performance outcomes. A combination of focus groups and semi-structured interviews were conducted during the validation process. This process emerged the development of an operational guide. This guide gives a systematic account of how the PMT can use the CMSM reflecting the project stages. The ISM technique assisted the modelling of the hierarchical structure of the IMSF based on the nature and degree of the interrelationship of nine identified influential drivers. The IRP technique aided the preparation of the hierarchical structure based on their dominance of the nine important driver with respect to the process performance pointers. The findings from the ISM and IRP helped to better structure the CMSM and its operational guide. This was validation in the final phase. The overall feedback from the expert on the CMSM and its operational guide were positive achieving the set-out validation objectives. Based on the results and findings of the validation exercise, propositions five and six were successfully tested and analytical generalisations made.

Based on the above results and findings, objective five of the research was achieved.

8.4 CONTRIBUTIONS OF THE STUDY

This section details the key contributions of the study to knowledge and practice.

8.4.1 Contribution to Theoretical Understanding

- ***CMS, poor cost performance, Low-cost housing project delivery***

The study has successfully enhanced the understanding of how project costs can be managed and the CMS impacts on cost performances. The research has described how conventional CMS influences project cost performance. It further emphasised that the choice of techniques and process approach influences the effective outcomes of the CMS. The research has enabled insights into the objective and subjective perceptions of scholars and experts across the three key teams that constitute the project management team who by their managerial influence are involved in the project cost management practice. Based on their opinions, the relationship between CMS and cost performance, the appropriate techniques process approach and success factors have been established. Thus, this study has provided an innovative perspective to managing the LcH project cost by providing directions for a holistic structural and an operational guide to effective CMS implementation. Besides, the current findings add to a growing body of literature on CMS and the LcH project delivery to enhance project management practices. Furthermore, the findings of the research form a platform for developing general guidelines to improving CMS best practices directly within the context of the LcH project delivery and set best practice examples that can be transferred for adoption in the LcH project delivery in a similar context, however, requiring further investigation. The emerging issues arising from the study provide an important guide that can be used to develop a best practice project cost management standard document for the practice or be incorporated into the existing practice standard measurement (e.g. Building and Engineering Standard Method of Measurement).

- ***Research Methodological process***

In the area of methodology, this research employed a case study design. It affirms that a single embedded case study design can be appropriate to test research propositions and generate analytical generalisations. It further affirms the suitability of using an exploratory sequential mixed method procedure to gather and analyse relevant data for the research. This procedure aided the exploration and identification of preliminary findings of useful themes when related concepts of the study were tangential. It further allowed the explanation, confirmation and validation of preliminary findings in the study context. This research methodological procedure can be useful to future researchers who intend to adopt mixed method procedure in case study designs.

- ***Insights into Success factors from CMS implementation perspective***

Construction literature shows extensive studies on success factors for effective cost performances, however, research on success factors for effective CMS implementation are rare. This study identified three important IMSF for effective CMS implementation namely, effective team qualities, effective information and management actions and a stable operational environment. These three IMSF possess nine influential and important drivers. The current study employing IRP and ISM identified the level of importance of the drivers holistically in the system and especially in relation with the performance pointers of the cost management process. These two techniques modelled the drivers' hieratical structure and in respect to performance pointers of the cost management process. Though previous scholars have identified drivers for effective cost performances and management but attempts to model the IMSF or associated drivers using novel techniques such as the ISM and IRP are lacking. This makes the study findings a novel contribution.

- ***Conceptual Cost management system model for LcH project delivery***

The study has presented a CMSM for the LcH project delivery that can be widely adopted in Nigeria and especially the southeast zone. The CMSM is a comprehensive model that displays the relation between techniques, process, and IMSF with indicators measuring effective project cost management towards achieving successful performance outcomes. The model provides a structural basis for achieving effective cost management in LcH projects. The model brings together research findings highlighting the appropriate techniques, process approach, and IMSF relevant to improve current CMS in use. The contents of the CMSM supports integration of effective modern cost management techniques (TC and EVA), a proactive process management approach (cost-design-control), and key IMSF for effective CMS implementation. Hence, the research contributes to developing a theory supporting the use of modern cost management systems on construction projects.

8.4.2 Contribution to Practice

The CMSM and proposed operational guide can promote effective cost management and optimisation towards successful cost performances. It can also assist the PMT to achieve value for money for public sector client given the funding constraints challenging the country. The CMSM provides a guide to assist the PMT to understand the specific roles of the technique at each stage of the project and the conditions under which they will be effectively implemented for effective cost performances. The CMSM is a valuable management tool that can also be used by the project manager as a monitoring tool to ensure compliance by the PMT in CMS implementation. It also provide a management tool for the housing agency project departments in Nigeria and especially the southeast zone to maintain standardise cost management practice and evaluation in LcH project delivery.

8.4.3 Contribution to a Comprehensive and Holistic Model for LcH Provision

Furthermore, findings show the emphasis on a comprehensive and holistic model for the LcH provision in Nigeria. Existing models associated with the LcH provision in Nigeria centres on the co-operative housing model, land allocation system, and affordable financing models (Fasakin, 1998; Oduwaye, 1998; Omole, 2001, cited in EFInA, 2010). Given the significant importance of the effective project cost performance in LcH project delivery and provision, a modern CMS model is needful to the PMT. Hence, the CMSM becomes a part of a viable strategy which can be domiciled in the state housing agencies to be used in facilitating effective LcH provision across the country and especially the southeast zone.

8.5 RESEARCH LIMITATION

The research limitations are the extent to which the research findings can be adopted. The limitations in this context are discussed under three main headings:

8.5.1 Generalisability of Findings

Case studies aim to achieve analytical generalisations from research propositions to establish a conceptual model (theory) as in this study context, which may apply to similar or another context (Yin, 2009). The specific parameters under which this study was conducted were stated earlier in the scope, it is also important to reemphasise that the generalisability of the findings of this study is analytically driven and is confined to CMS for LcH project delivery in the Nigeria. This limitation emerges because the model was developed based on the expert opinions of the PMT involved in the LcH project delivery in Nigeria using a case study of the southeast zone. Therefore, the CMSM and its operational guide are specific to both LcH project delivery in the southeast zone and Nigeria. However, reports have shown that developing countries have common characteristics in terms of social and economic characteristics, and many share similar characteristics in LcH project delivery and provision (UN-Habitat 2011a; 2011b; Chigara et al., 2013). Therefore, the CMSM can apply to those developing countries that share similar characteristics with Nigeria. While those with different contextual peculiarities like developed countries may need adjustments that will require further contextual investigations.

8.5.2 Methodology Related

The study followed an exploratory sequential mixed method procedure where the findings from the qualitative phase influenced the procedure in the quantitative phase. For instance, in this context, the participants' responses to the interview questions informed the development of the questionnaires. Furthermore, the contextual relationships among the components of the CMSM were all dependent on the experts' opinions of the PMT involved in the LcH projects in the Nigeria construction industry. Therefore, the process may have some influence on the study's outcome, which can be difficult to determine but not denied. Hence, it is important not to consider the outcome of the study as being very free from the methodological influence.

8.5.3 Model Validation Limitation

At the onset of the study, it was proposed that the CMSM will be tested on real-life projects during the final validation phase. However, the political change in the country's (Nigeria) administration in May 2015 affected this initial study presumption. As at the time of the final validation phase, several LcH projects were still awaiting commissioning, and those with sectional completions due to start were delayed with no tentative start date. These developments were considered as limitations because the researcher also needs to complete the PhD programme within the set period. As an alternative, the researcher resorted to CMSM validation by expert opinions. Selected members of the PMT were engaged and the CMSM validated.

8.6 RECOMMENDATIONS

Considering the findings and conclusions of this research, the following recommendations are made to improve current cost management practices:

8.6.1 Recommendations for PMT

- An assessment of the effectiveness of the CMS used in LcH project delivery should be a continuous process. The CMSM can be used as a constant guide to explore and identify areas of necessary improvement in the CMS u given changes that may result from contemporary practice.
- The PMT should ensure that their project staff directly involved in the CMS LcH project implementation, have the right qualification, experience and collaborative skills necessary for effective cost management practice on the project. This is because the successful implementation of the CMS is a pivot to realising effective the LcH project performances.
- All PMT members should be required to undertake periodic collaborative workshop and training in the use to improve their use of TC and EVA and to abase themselves with the use of the techniques highlighted in the CMSM before the commencement of any LcH project.
- Continuous professional training and development should be an unrelenting effort by the PMT members in order to improve their level of awareness and competencies on various modern techniques and methodologies for improved LcH project cost management. This is necessary for evolving contemporary practice in LcH project delivery in the future.

8.6.2 Recommendations for Housing Agency

- This study reports that effective cost management should begin at the predesign stage of the project. As such, to avail the assessment of an effective CMS in LcH project delivery, the CMSM is recommended. The CMSM should be a submission requirement for LcH project delivery and embodied in the contract documents.

- According to the present research, the commitment and full involvement of the housing agency project team are essential for effective CMS implementation. Therefore, this study recommends that they engage rigorously in every stage of the cost management process to set best practice examples that can facilitate effective collaboration within other members of the PMT.
- This study, therefore, recommends that the housing agency project team should take proper consideration to ensure that the PMT organisations possess adequate knowledge of cost management practice based on their educational and professional backgrounds. It is also important that they possess relevant experiences in the roles they intend to undertake the project. Where necessary, focus group meetings and presentations can be used for their assessment and validations. This is because effective team qualities as key IMSF for effective CMS implementation.
- As part of its findings, it was also observed that the type of procurement strategy adopted by the project sponsors impacts on the level of effective collaboration. Given the role of effective team collaboration in CMS implementation, this study recommends that the housing agency project team adopt a well-structured system that can facilitate early contractor involvement on the project. An example is adopting an integrated team approach. In the absence of this, the temporary service of an experienced contractor can be sought to gain contractors experiential contribution and cost feedback that will be helpful in the effective implementation of the CMS at the early process stages.
- The conditions of engagement of consultants and contractors relating to the LcH project delivery should be reviewed by housing agencies in order to make all PMT stakeholders responsible for effective cost management implementation at all stages of the project, and thereby, encouraging collaborative approaches.
- The housing agency should ensure that special arrangements be put in place to facilitate adequate and effective cash flow as well as an adequate resolution of land compensation issues before the commencement of the construction stage. This is because these drivers associated with stable operational environment factors which are external to the influence of the PMT can affect effective monitoring and cost control.

8.6.3 Recommendation for Further Research

- This current study validates the CMSM using expert opinions. It recommends CMSM testing on real life LcH project delivery in Nigeria for further validation. Multiple cases studies or other appropriate procedures could also be employed to measure the level of significant cost savings to extend analytical or statistical generalisations across Nigeria.
- Poor cost management and performances are a major problem across the globe. Hence, it is recommended that a future studies can test and evaluate the applicability and performance of the CMSM in other building related projects in both developed and developing country context.
- The emergent CMSM provides a platform that will aid continuous evaluation and improvement in the CMS for LcH the project delivery in the case that other effective techniques evolve in the future. It particularly enables the conceptualisation of the relationships within the components of the system. Therefore, it provides a platform for researchers to conceptualise system components given changes in contemporary cost management practice.
- This study highlights time and quality as other criteria defining LcH project success. Following CMSM development, future studies can use the documented procedures used in conducting this research as a platform to develop systems in other areas of time and quality management.
- As part of its findings, the quality of the PMT is highly important for CMS implementation. However, the study did not go further to evaluate the influence of relationship within the PMT on CMS implementation. This study therefore recommends a future research on this path, as it would be of immense benefit to project sponsors and managers. It would also enable project sponsors to have a contextual benchmark requirement for engaging PMT organisations.
- This study affirms target costing as an appropriate technique in the CMS. However, recent studies advocate an evolving technique- Target value design. The evolution of the TVD from the TC though still in its experimental stage on housing projects is an advancement in the area construction research. In this regards, a TVD implementation model for LcH project cost management in Nigeria is a potential area for future research.

- CMSM is a generic management tool, therefore, future studies can investigates its applicability in a comparative study of alternative technological approaches for LcH construction towards cost optimisation.

8.6.4 Recommendation for Academia

- The research findings show a poor awareness of modern techniques such as TC, TVD, EVA and ABC. Therefore improving future practice will require effective knowledge in contemporary CMS components. Hence, a review of the current teaching curriculum in higher institutions of learning is needed to accommodate the integration of emerging modern techniques and procedures

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LIST OF APPENDIXES

APPENDIX I. List of publications

- Obi L. I., Arif, M., Kulonda D.J. (2016). Prioritizing Cost Management System Considerations for Nigerian Housing Projects. Manuscript submitted for publication.
- Ihua, P.W and Obi, L.I. (2015). Effective Compact Agreements: Improving Public Housing Estates' Delivery and Post-Construction Management in Nigeria. *Journal of Research in Business and Management,* 3(5): 17-27.
- Obi, L., Arif, M., and Awuzie, B. (2015). Significant waste factors influencing delivery cost performance of design and build low-cost housing projects in Imo State Nigeria. *Journal of Construction Project Management and Innovation*, *5*(2), 1152-1175.
- Obi, L., Arif, M., and Awuzie, B. (2015). Waste Factors Impacting on Delivery Cost Performance of Design and Build Low-cost Housing Projects in Nigeria: *In Proceedings of 12th International Postgraduate Research Conference University of Salford United Kingdom*. 10-12th June 2015.
- Obi, L.I. and Arif, M . (2015). A Case for Target Value Design Towards Effective Low-Cost Housing Project Cost Management And Performance South-East Zone Nigeria. In C. Egbu(Ed.*), In proceedings of Going north for sustainability: Leveraging knowledge and innovation for sustainable construction and development:* CIB International Conference London south bank university London, 23 - 25 November 2015 (pp. 104-114). London: IBEA Publications Ltd.
- Obi, L. and Arif, M. (2015). Towards a conceptual model for effective delivery cost management of low-cost housing projects in Southeast, zone of Nigeria. *SOBE University of Salford Dean's Annual Research Showcase*
- Obi, L. and Arif, M. (2015). Evaluation of Critical Success Factors to Effective Low-cost Housing Project Cost Management in South East Zone Nigeria. Paper presented at the 8th MMU Postgraduate Research Conference, Manchester, United Kingdom 5th November, 2015.
- Obi, L.I (2014). Assessing the Critical Cost Factors in Low Cost Housing Provision. University of Salford research Showcase 2014- Book of Abstracts ISBN: 978-1-907842-56-6.

APPENDIX II Ethical Approval Letter

Academic Audit and Governance Committee

College of Science and Technology Research Ethics Panel (CST)

University of Salford MANCHESTER

MEMORANDUM

To	**Lovelin Ifeoma OBI (and Prof Mohammad Arif)**
cc:	**Professor Hisham Elkadi, Head of School of SOBE**
From	**Nathalie Audren Howarth, College Research Support Officer**
Date	**2/03/2015**

<u>Subject:</u>	**Approval of your Project by CST**
<u>Project Title:</u>	**Effective Cost Management of low cost housing project Delivery in Nigeria**
<u>REP Reference:</u>	**CST 15/02**

Following your responses to the Panel's queries, based on the information you provided, I can confirm that they have no objections on ethical grounds to your project.

If there are any changes to the project and/or its methodology, please inform the Panel as soon as possible.

Regards,

Nathalie Audren Howarth
College Research Support Officer

For enquiries please contact:
College of Science and Technology
College Research Support Officer
The University of Salford
Maxwell building, (7th floor, room 721)
Telephone: 0161 295 5278
Email: n.audren@salford.ac.uk

APPENDIX III Sample of Organisation Invitation letter

University of Salford
MANCHESTER

4th Floor Maxwell Building,

School of the Built Environment
The University of Salford,
M5 4WT,
Manchester
United Kingdom.

Date……………..

Dear Sir/Madam,

ORGANISATIONAL INVITATION AND CONSENT LETTER

I humbly write to invite your organisation to seek your consent to be a part of this on-going research. I am currently a PhD research student in the School of the Built Environment, University of Salford, United Kingdom conducting a research: **Towards an Effective Project Cost Management System for Low-cost Housing Project Delivery in Nigeria.** The aim of this research is to develop a conceptual system model to assist the project management team achieve improved and effective cost management and performances.

Your organisation is selected because it has been involved as a member of the project management team in Low-cost Housing Project Delivery in the zone over the years. As a result I believe your organisation possess the required knowledge and experience expedient for a research of this nature. This research solicit your views on cost management practice. Given your consent, I will be seeking audience with your professional staff experienced and knowledgeable in contemporary practices associated with low-cost housing project delivery and project cost management system to take part in the semi structured interviews or questionnaire. Their opinions based on your organisations involvement in the cost management practice on these projects is needful to actualise the research aim and objectives.

I would also like to emphasise and guarantee you that, the purpose of this research is solely academic. Any information about the details of your organisation or professional staff expected to participate in the research will be anonymised and strictly kept confidential.

I would be very grateful if you could confirm your consent by replying through the above contact details within two weeks of receipt of this letter. If you have any queries or require more information, kindly reach me on the above address or contact PMA who is currently supervising this research work.

Yours Faithfully,

LIO (PhD Research Student)

APPENDIX IV Sample of Letter of Invitation

4th Floor Maxwell Building,

School of the Built Environment
The University of Salford,
M5 4WT,
Manchester
United Kingdom.

Dear Sir/Madam,

LETTER OF INVITATION

I humbly write to invite your organisation to seek your consent to be a part of this on-going research. I am currently a PhD research student in the School of the Built Environment, University of Salford, United Kingdom conducting a research: **Towards an Effective Project Cost Management System for Low-cost Housing Project Delivery in Nigeria.** The aim of this research is to develop a conceptual system model to assist the project management team achieve improved and effective cost management and performances.

I am inviting you to kindly participate in this research. Given your level of involvement in the low-cost housing project selected and knowledge in the cost management practice on such projects, I believe your contribution would be of significant value to the research. The interview will be short (30-50 minutes), arranged and held at the most suitable time and date for you.

Please let me know if this is of interest to you, by formally accepting this invitation, with a reply within two weeks through the above contact details. This reply would be very much appreciated. Consequently, I will send additional information on participation procedure, including an interview Participant Consent Form, Information Sheet, and a draft Interview Guide. I would also like to emphasise and guarantee you that the contents of the interview will be kept strictly confidential and anonymous and would only be used for the purpose of this academic research.

If you have any queries or require more information, kindly reach me on the above address or contact. Should you wish to clarify on the authenticity of this research or more about the context of the study you could also contact PMA who is currently supervising this research work.

I look forward to hearing from you,

Yours Faithfully,

LIO

PhD Research Student

University of Salford MANCHESTER

Dear Sir/Madam,

LETTER OF INVITATION

I humbly write to invite your organisation to seek your consent to be a part of this on-going research. I am currently a PhD research student in the School of the Built Environment, University of Salford, United Kingdom conducting a research: **Towards an Effective Project Cost Management System for Low-cost Housing Project Delivery in Nigeria.** The aim of this research is to develop a conceptual system model to assist the project management team achieve improved and effective cost management and performances.

I am inviting you to kindly participate in this research. Given your level of involvement in the low-cost housing project delivery in the zone and knowledge in the cost management practice on such projects, I believe your contribution would be of significant value to the research. Your participation would only involve responses to a 15-minute questionnaire hand delivered, emailed or posted, whichever you indicate most suitable for you.

Please let me know if this is of interest to you, through the above contact details. In which case, I will then send additional information on the participation procedure, including a questionnaire, respondent Consent Form and an Information Sheet. I would also like to emphasise and guarantee you that, the contents of your completed response to the questionnaire will be kept strictly confidential and anonymous and would only be used for the purpose of this academic research.

If you have any queries or require more information, kindly reach me on the above address or contact. Should you wish to clarify on the authenticity of this research or more about the context on the study you could also contact PMA who is currently supervising this research work.

I look forward to hearing from you.

Yours Faithfully,

LIO

PhD Research Student

APPENDIX V Sample of Informed Consent Form

University of Salford MANCHESTER

Research Topic: Towards an Effective Project Cost Management System for Low-cost Housing Project Delivery in Nigeria

Kindly tick in agreement in the boxes provided.

Having read and understood the information sheet for the above mentioned study and need for my contributions I hereby consent to the following:

- I confirm also that I have been given the opportunity to ask questions as it concerns the research process and other ancillary matters which might arise as a result of the process ☐
- I hereby do agree to participate in the interview organised for the sole purpose of generating data for this study. ☐
- I agree to the interview sessions to be recorded by the interviewer ☐
- I also I also consent to the researcher publishing the results however using anonymised quotes and codes to protect my identity and promote confidentiality especially in future publications emanating from the data provided. ☐
- I do understand that my participation is strictly voluntary and as such I have the option to withdraw during the interview if required without giving any reasons whatsoever with regards to what might have prompted my withdrawal. ☐
- I do hereby **AGREE** to participate in this research study. ☐

Name:..

Signature: ....

Date: ....

Post: LIO

School of the Built Environment, The University of Salford, M5 4WT, United Kingdom.

INFORMED CONSENT FORM FOR RESPONDENTS

(To be completed after Participant Information Sheet has been read)

Kindly tick in agreement in the boxes provided.

Research Topic: Towards an Effective Project Cost Management System for Low-cost Housing Project Delivery in Nigeria

Having read and understood the information sheet for the above mentioned study and need for my contributions I hereby consent to the following:

- I confirm also that I have been given the opportunity to ask questions as it concerns the research process and other ancillary matters which might arise as a result of the process ☐
- I hereby do agree to participate in study as a respondent to the questionnaire for the sole purpose of generating data for this study. ☐
- I agree to the interview sessions to be recorded by the interviewer ☐
- I also I also consent to the researcher publishing the results however using anonymised quotes and codes to protect my identity and promote confidentiality especially in future publications emanating from the data provided. ☐
- I do understand that my participation is strictly voluntary and as such I have the option to withdraw during the interview if required without giving any reasons whatsoever with regards to what might have prompted my withdrawal. ☐
- I do hereby **AGREE** to participate in this research study. ☐

Name:...

Signature: ....

Date: ....

Post: LIO

School of the Built Environment, The University of Salford, M5 4WT, United Kingdom.

APPENDIX VI Semi-Structured Interview Guide

Towards An Effective Project Cost Management System for Low-Cost Housing Project Delivery in Nigeria

PART A: GENERAL PARTICIPANT INFORMATION

Please provide the following information by ticking the appropriate boxes

1. **What is your organisation's role in Low-cost housing project delivery?**
   - Contractor ☐
   - Consultant ☐
   - Housing Agency ☐
   - Other, please specify……………….

2. **How long has your organisation been involved in Low-cost housing project delivery in the zone?**
   - Under 5 years ☐
   - 5< 10 years ☐
   - 10<15 years ☐
   - 15years and above ☐

3. **Which type of Low-cost housing project has your organisation been involved?**
   - Federal-led project ☐
   - State -led projects ☐
   - Both ☐

4. **What is your professional role in the organisation?**
   - Engineer ☐
   - Builder ☐
   - Quantity surveyor ☐
   - Architect ☐
   - Other ☐

5. **What is your highest academic qualification?**
   - Graduate level ☐ Kindly specify……………………..
   - Post Graduate level ☐ Kindly specify……………………..

6. **How long have you been involved in Low-cost housing project delivery?**

Under 5 years ☐
5< 10 years ☐
10<15years ☐
15 ears and above ☐

7. **Do you have a clear knowledge and understanding of the cost management practice in Low-cost housing project delivery?**

Very knowledgeable ☐
Knowledgeable ☐
Somewhat Knowledgeable ☐
Not Knowledgeable ☐

SECTION 2: LOW COST HOUSING PROJECT DELIVERY

8. In your view, kindly describe the concept of low-cost housing project delivery
9. What criteria defines a successful Low-cost Housing project?
10. From the client's view, which of these criteria would you consider most prioritised and why?
11. What do you understand by effective project cost performance?

SECTION 3: PROJECT COST MANAGEMENT SYSTEM

12. Who is involved in implementing the cost management system employed in low-cost housing project delivery?
13. What techniques are employed in the system for project cost management?
14. What process approach is adopted in the system for project cost management?
15. Is there a relationship between cost management system employed and cost performance of a low-cost housing experienced?
16. How effective is the cost management system employed on achieving effective Low-cost Housing project cost performances?
17. What are the inherent constraints affecting the efficacy of current system(s) employed?

SECTION 4: DRIVERS FOR EFFECTIVE IMPLEMENTATION IN THE PROJECT COST MANAGEMENT SYSTEM

18. What drivers do you consider pivotal to maintain effective and viable implementation of the techniques and process in the cost management system in Low-cost housing project delivery?

SECTION 5: IMPROVING THE EFFICACY OF CURRENT COST MANAGEMENT SYSTEM FOR LOW-COST HOUSING PROJECT DELIVERY

19. What measures can be adopted to improve the efficacy of current cost management system (s) employed in low-cost housing project delivery?
20. How can the measures be implemented?

APPENDIX VII Questionnaire

4th Floor, Maxwell Building

School of Built Environment

M5 4WT

Manchester

United Kingdom

08/04/2015.

Dear Respondent,

Towards an Effective Project Cost Management System for Low-cost Housing Project Delivery in Nigeria

I am conducting a study on the above topic as part of my PhD research at University of Salford. This research is aimed at developing and proffering an appropriate system model to facilitate effective cost management and performances of Low-cost housing project delivery in the Nigerian southeast zone. The proposed model is for the benefit of Project Management Team(s) directly involved in the cost management practice on these projects in the zone. The questionnaire is developed from the findings of semi-structured interviews earlier conducted. The purpose of this questionnaire is to gather relevant information on the specific components to be included in the proposed model. I will appreciate if you could complete this questionnaire, which should take about 15 minutes and return within four weeks of receipt to the address or email as shown. Please be assured that your response will be kept confidential, anonymous, and only group data will be reported and presented.

If you have any questions about this research study, please contact me on +447831969062, +2348064367029 or e-mail at L.i.Obi@edu.salford.ac.uk.

Thanking you for your cooperation in completing this questionnaire.

Yours sincerely

Lovelin Obi

PART A: GENERAL RESPONDENT INFORMATION

Please provide the following information by ticking the appropriate boxes

1. **What is your organisation's role in Low-cost housing project delivery?**
   - Contractor ☐
   - Consultant ☐
   - Housing Agency ☐
   - Other, please specify………………

2. **How long has your organisation been involved in Low-cost housing project delivery in the zone?**
   - Under 5 years ☐
   - 5< 10 years ☐
   - 10<15 years ☐
   - 15years and above ☐

3. **Which type of Low-cost housing project has your organisation been involved?**
   - Federal-led project ☐
   - State -led projects ☐
   - Both ☐

4. **What is your professional role in the organisation?**
   - Engineer ☐
   - Builder ☐
   - Quantity surveyor ☐
   - Architect ☐
   - Other ☐

5. **What is your highest academic qualification?**
   - Graduate level ☐ Kindly specify……………………..
   - Post Graduate level ☐ Kindly specify……………………..

6. **How long have you been involved in Low-cost housing project delivery?**
   - Under 5 years ☐
   - 5< 10 years ☐
   - 10<15years ☐
   - 15 years and above ☐

7. **Rate your level of clear knowledge and understanding of the cost management practice on Low-cost housing project delivery?**

   Very knowledgeable ☐
   Knowledgeable ☐
   Somewhat Knowledgeable ☐
   Not Knowledgeable ☐

PART B: MAIN SURVEY

In this part B, kindly provide answers to the questions asked by circling/ticking in the appropriate box.

Section 1: Low-cost Housing Project Delivery

The purpose of this section is to understand the inherent peculiarities of Low cost housing project delivery in the Nigerian southeast zone.

8. To **what extent do you agree** with the following statements on Low-cost housing project delivery?

Meaning of scale: 1-Strongly disagree •· 2 - Disagree • 3 -Agree • 4 -Strongly Agree•

Description of Low cost Housing project	**Level of Agreement**			
They are Government-led projects to construct adequate houses affordable mainly to Low and Lower-Medium Income group	**1**	**2**	**3**	**4**
Projects consist of 1-3 bedroom prototype mass housing of regulated specifications in size and aesthetic design , cost, time and basic quality	**1**	**2**	**3**	**4**

9. To **what extent do you agree** that effective project cost performance is a highly prioritised criterion defining Low-cost housing projects success?

Meaning of scale: 1-Strongly disagree •· 2 - Disagree • 3 -Agree • 4 -Strongly Agree•

Highly prioritised criterion	Level of Agreement			
Effective project cost performance is a highly critical success criterion	**1**	**2**	**3**	**4**

Section 2: Characteristics of the Project Cost Management System

Project cost in this context is defined as the amount spent by the client (housing agency) to execute a Low-cost housing project from predesign to construction. This section focuses on understanding the characteristics of the system(s) employed for cost management in Low-cost housing project delivery in the southeast zone. It covers the Project Management Team involvement, techniques, process approach and system efficacy on expected outcomes.

10. What is the **level of involvement** of the identified Project Management Team in LcH project cost management?

11.

Meaning of scale: 1-Not involved• 2 - Somewhat involved • 3 - Involved• 4 –Fully involved

Project Management team	**level of Involvement**			
Housing agency supervision team	1	2	3	4
Contractors	1	2	3	4
Consultants	1	2	3	4

11a. What is the **frequency of use** of the following identified cost management techniques in Low-cost housing project delivery?

Meaning of scale: 1-Never • 2 – Rarely • 3 – Often • 4 – Always •

Cost management Techniques	Frequency of use			
Traditional cost planning	1	2	3	**4**
Traditional cost estimating	1	2	3	**4**
Cash flow analysis	1	2	3	**4**
Target costing	1	2	3	**4**
Site meetings	1	2	3	**4**
Cost Variance	1	2	3	**4**
Cost scheduling	1	2	3	**4**
Earned value analysis	1	2	3	**4**
Onsite resource control	1	2	3	**4**
Cost reporting	1	2	3	**4**

11b. What is your level of agreement that all the above listed cost management techniques in question 11a are effective for project cost management when used appropriately.

Meaning of scale: 1-Strongly disagree •· 2 - Disagree • 3 -Agree • 4 -Strongly Agree•

Efficacy of identified Cost management techniques	Level of Agreement			
listed cost management techniques in question 11a are effective for project cost management when used appropriately	1	2	3	4

12a. What is you extent of agreement on the following as stages in the cost management process?

Meaning of scale: 1-Strongly disagree •· 2 - Disagree • 3 -Agree • 4 -Strongly Agree•

Stages	level of Agreement			
Setting	**1**	**2**	**3**	**4**
Planning and estimating	**1**	**2**	**3**	**4**
Budgeting	**1**	**2**	**3**	**4**
Monitoring and control	**1**	**2**	**3**	**4**

12b. What is the **frequency of use** of the following identified approaches in the cost management process in Low-cost housing project delivery?

Meaning of scale: 1-Never • 2 – Rarely • 3 – Often • 4 – Always

Process Approach	Frequency of use			
Design-cost-control (Set cost after designs and control)	**1**	**2**	**3**	**4**
Cost-design-control (Set cost before designs and control)	**1**	**2**	**3**	**4**

13. What is your rating on the influence of ineffective cost management system on poor LcH project cost performances?

Meaning of scale: 1-No influence •· 2 – Less influence • 3 –Strong influence • 4 – Very strong influence•

Cost performance of Low-cost housing projects	Level of Influence			
Ineffective cost management system contribute to poor cost performances of Low-cost housing projects	**1**	**2**	**3**	**4**

13b. To **what extent do you agree** with the following statements on current cost management systems employed in low-cost housing project delivery:

Meaning of scale: 1-Strongly disagree •· 2 - Disagree • 3 -Agree • 4 -Strongly Agree•

Current cost management systems	Level of Agreement			
Difficulty in monitoring real time project performances	**1**	**2**	**3**	**4**
Difficulty to effectively plan and control of project cost within client target budget	**1**	**2**	**3**	**4**
Create rooms for variations affecting cost control	**1**	**2**	**3**	**4**
The system techniques are insufficient to facilitate effective outcomes	**1**	**2**	**3**	**4**
The current systems are unable to facilitate effective project cost performances hence need improvement	**1**	**2**	**3**	**4**

14. To **what extent do you agree** with the following statements on the identified outcomes/benefits of an effective cost management system in Low-cost Housing project delivery?

Meaning of scale: 1-Strongly disagree •· 2 - Disagree • 3 -Agree • 4 –Strongly Agree

Contributions of effective Cost management systems	Level of Agreement			
Lead to improved and effective project cost management	**1**	**2**	**3**	**4**
Improved client satisfaction	**1**	**2**	**3**	**4**
Facilitates effective cost performances	**1**	**2**	**3**	**4**
Facilitates effective cost feedback for future projects	**1**	**2**	**3**	**4**
Facilitates improved value for money	**1**	**2**	**3**	**4**

Section 3: Drivers for effective technique and process implementation in the cost management system

This section focuses on specifically identifying the drivers essential for effective implementation of the techniques and process in the system. It starts with the recognition of certain barriers militating successful implementation and goes further to highlight the important drivers necessary to mitigate the barriers and aid effective and viable implementation in the system.

15a. The following barriers are identified to have affect effective techniques and process implementation in the cost management system for LcH project delivery. Kindly rate their level of influence?

Meaning of scale: 1-No influence •· 2 – Less influence • 3 –Strong influence • 4 – Very strong influence•

Barriers	Level of influence			
Unclear client brief	**1**	**2**	**3**	**4**
Poor collaboration and communication of tam members	**1**	**2**	**3**	**4**
Professional incompetency	**1**	**2**	**3**	**4**
Inadequate knowledge in cost management	**1**	**2**	**3**	**4**
Lack of adequate project planning	**1**	**2**	**3**	**4**
lack of cost data bank	**1**	**2**	**3**	**4**
Errors in details and estimates	**1**	**2**	**3**	**4**
Design changes and variations	**1**	**2**	**3**	**4**
Poor site and resource supervision	**1**	**2**	**3**	**4**
Incompetent contractors site workers	**1**	**2**	**3**	**4**
Delay in Funding	**1**	**2**	**3**	**4**
Government bureaucratic process affecting work approvals	**1**	**2**	**3**	**4**
Economic instability	**1**	**2**	**3**	**4**
Political instability	**1**	**2**	**3**	**4**
Inclement Weather conditions	**1**	**2**	**3**	**4**
Community restiveness	**1**	**2**	**3**	**4**
Burglary	**1**	**2**	**3**	**4**

15b. The listed drivers are identified necessary for effective techniques and process implementation in the cost management system for LcH project delivery. Kindly rate the **level of their influence**?

Meaning of scale: 1-No influence •· 2 – Less influence • 3 –Strong influence • 4 – Very strong influence•

Drivers	Level of influence			
Competent design team professionals	**1**	**2**	**3**	**4**
Effective team collaboration and commitment	**1**	**2**	**3**	**4**
Detailed project designs and specifications	**1**	**2**	**3**	**4**
Clearly and well developed client project brief	**1**	**2**	**3**	**4**
Effective project planning and site supervision	**1**	**2**	**3**	**4**
Availability of cost data	**1**	**2**	**3**	**4**
Competent contractor team	**1**	**2**	**3**	**4**
Adequate and effective cash flow	**1**	**2**	**3**	**4**
Early contractor involvement	**1**	**2**	**3**	**4**
Stable economic environment	**1**	**2**	**3**	**4**
Stable weather conditions	**1**	**2**	**3**	**4**
Adequate resolution of land compensation issues	**1**	**2**	**3**	**4**
Stable political environment	**1**	**2**	**3**	**4**

Section 4: Improving the efficacy of current cost management system for Low-cost Housing project delivery

16. It is highlighted that cost management system influences project cost performances. If you agree to this statement, kindly rate the **level of influence** of effective project cost management systems on effective cost performance of Low-cost housing projects.

Meaning of scale: 1-No influence• 2 -Less influence • 3 strong influence • 4-Very **strong** influence

Relationship between effective cost management system and cost performances	Level of Influence			
Effective cost management system influence on effective cost performances of Low-cost housing projects	**1**	**2**	**3**	**4**

17. What is your l**evel of agreement** on the following recommendations for improving current cost management systems

Meaning of scale: 1-Strongly disagree •· 2 - Disagree • 3 -Agree • 4 –Strongly Agree

Improving Current cost management systems	Level of Agreement			
Adopt the frequent use of Target costing and Earn value analysis	**1**	**2**	**3**	**4**
Adopt a cost-design-control process approach	**1**	**2**	**3**	**4**
Integrate all the drivers important for effective implementation in the system	**1**	**2**	**3**	**4**
A comprehensive system Model that can assist project management team to implement effective Cost management in Low-cost housing project delivery in the zone.	**1**	**2**	**3**	**4**

18. Recommendation is that a comprehensive system model can assist the project management team to implement effective cost management in Low-cost housing project delivery in the zone. Kindly **rate your level of agreement** on this statement.

Meaning of scale: 1-Strongly disagree •· 2 - Disagree • 3 -Agree • 4 –Strongly Agree

Comprehensive cost management system model	Level of Agreement			
Can assist project management team to implement effective Cost management in Low-cost housing project delivery in the zone.	**1**	**2**	**3**	**4**

APPENDIX VIII Model Validation Guide

Introduction

One of the reasons for unsuccessful realisation of many Low-cost housing schemes in Nigeria, is attributed to the poor cost perfomances of the projects. Consequently, poor cost performances of low-cost housing projects has been blamed on ineffective cost management systems employed. The insufficiency and lack of appropriate choice of techniques, process approach and lack of considerations of certain key implementation success factors are the main identified contrainsts of the systems. Previous attempts by various scholars failed to identify these contraints because of the absence of a proper evaluation of the cost management system adopted. Neither have they proffered a well-developed and appropriate system model that can assist the project management team achieve effective cost management and performances. In this regards, this study evaluates the charcteristics and efficacy of project cost mangement systems employed in low-cost housing project delivery with a view to develop the CMSM. The CMSM not only conceptualises the various techniques, process approach and implementation success factors but also provides the basis for the subsequent evaluation of the system component relationships.

Description of Model

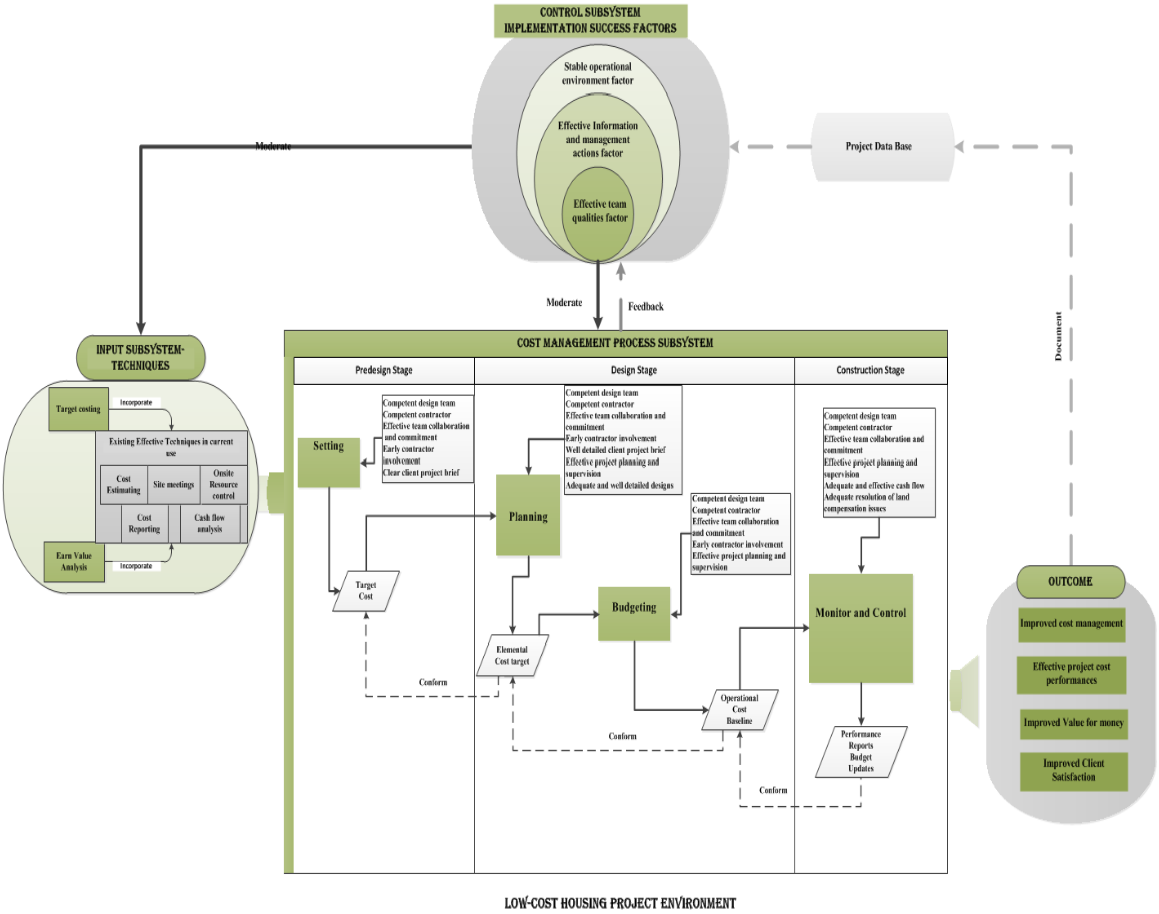
The CMSM is a model premised on the principles of process modelling: the input- process-outcome (IPO), interpretive structural modelling and interpretive ranking process. The contents of the proposed CMSM helps the PMT to identify the potential techniques, process approach and respective IMSFs for effective cost management practice at the predesign, design, and construction stages of LcH projects towards effective performances outcomes. The CMSM models an improved cost management system displaying the relationship of techniques, process approach, implementation success factors leading to potential resultant system outcomes. An effective cost management system has been described as a system that has the potential to achieve effective target cost, elemental cost targets operational baseline and proffer real time performance indicators towards realising effective cost performance outcomes amongst other system benefits.

The study has shown certain criteria imperative to define an effective system. These criteria consist of the following, namely:

- Presence of appropriate and effective cost management techniques (input subsystem)

- Presence of a cost- design-control process approach (process subsystem)
- Presence of three implementation success factors (contol subsystem)

A draft of the CMSM is provided below. Kindly go through the diagram and answer the questions below.



Validation Questions

1. Is the CMSM a true representation of the structure of the CMS in reality?
2. Does the CMSM clearly represent the relationships between the techniques, process and success factors in a CMS?
3. Can the improved cost management system lead to the potential performance outcomes as modelled in the CMSM?
4. Is the CMSM clear and easily understood by its users?
5. Is the CMSM and guide usable in real life context
6. Can the CMSM and its guide assist the PMT achieve effective project cost management and performances?