Prioritizing Cost Management System Considerations for Nigerian Housing Projects

Journal:	*Journal of Financial Management of Property and Construction*
Manuscript ID	JFMPC-06-2016-0025.R4
Manuscript Type:	Research Paper
Keywords:	Cost management system, Factor Analysis, Interpretive structural modelling, Low-cost housing project, Success factor

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ABSTRACT

Purpose- This study develops a success factor model to understand and facilitate improved cost management system (CMS) implementation in Low-cost housing (LcH) project delivery in Nigeria.

Design/methodology/approach- Literature findings highlight thirteen drivers' affecting effective implementation within the CMS and employs series of brainstorming sessions and questionnaire survey to validate the drivers'. Factor analysis (FA) identifies possible contextual relationships among the validated drivers' and groups them into three success factors. The results of the FA are refined employing interpretive structural modelling (ISM). The ISM identifies and models the influential drivers' and aids the development of the success factor model.

Findings- Effective team qualities, information and management actions and a stable operational environment are the three essential success factors for effective CMS implementation.

Practical implications- The paper highlights effective team qualities as the most important CMS considerations for Nigerian LcH project delivery. This finding creates the needed awareness to guide project sponsors and project managers in the appropriate selection of Project Management Team (PMT) as well procurement system that facilitates their collaboration.

Originality/value- This study is a novel research using FA and ISM to investigate the influence of success factors needful for effective implementation within the CMS. It further develops a hierarchy model that aids the PMT with the better understanding of the drivers' and factors interrelationships for use on LcH projects within the Nigerian context.

KEYWORDS: Cost management system, success factor, factor analysis, interpretive structural model, Low-cost housing project

1. Introduction

Poor cost performance occurs when the final project cost exceeds initial target cost (Odediran et al., 2014). This issue is one major challenge affecting many construction projects across the globe and particularly in developing countries like Nigeria. The performance of the housing and construction sector, a significant area contributing up 16 percent of the Nigerian economy (Isa et al., 2013) is apparently declining by the increasing occurrence of this challenge. This challenge is more severe on Low-cost housing (LcH) projects. LcH projects are multiple residential housing developments with standardised design and construction in same or several geographical locations, implemented under same project scheme and management and contract (Adinyira et al., (2013).These projects are mainly government sponsored and initiated to meet the housing need of the low and lower-middle income group in the country (Federal Ministry of Lands, Housing and Urban Development (FMLHUD), 2012; (Obi et al., 2015). A study by Akinde (2012) and the FMHLUD (2012) report show a rising trend of poor cost performances of LcH project delivery in Nigeria since post-independence. This trend has triggered serious concerns by public sector clients. Such concerns are its visible impact on the high sale prices of LcH undermining affordability of many target beneficiaries (Okoroafor, 2007), and a significant percentage of the socio-economic consequences of the existing housing situations across the country (Ogbu et al., 2012) among many others. LcH is a popular demand by a vast majority constituting up to 80 percent of the Nigerian population and a pivot to sustainable economic growth in the near future. Therefore, the Project Management Team (PMT) comprising the housing agency supervision team, consultancy and contracting teams (Ogbu et al.,2012) need to adopt viable strategies to address the problem of LcH poor project cost performances across the country.

Past studies (Oladapo, 2001; Akinde, 2012; Ogbu et al., 2012) established that employing effective and appropriate project cost management systems (CMS) could achieve effective project cost performances. Evidence also show that the success of the CMS on project cost performances depends on appropriate choice of effective cost management techniques and process approach (Kern et al., 2006; Obi et al., 2015). Besides, the consideration of certain success factors is necessary for their effective implementation (Sanvido 1988; Olawale et al., 2010; Windapo, 2013). Numerous researchers have attempted to proffer appropriate recommendations for CMS technical improvement, though only a few of such studies are found on LcH projects and particularly in the Nigerian context (Kern et al., 2006; Jacomit et al., 2011; Obi et al., 2015). However, rare attempts explore the salient success factors necessary for their effective implementation within the CMS. According to Olawale et al. (2010) without the identification and understanding of these success factors, achieving effective CMS implementation can be quite challenging. Hence, this study seeks to develop a success factor model. This model expects to assist the PMT in the effective implementation in the CMS for improved cost management in LcH project delivery in Nigeria.

This study is structured into eight sections. Following this introduction is a review of the literature on CMS and success factors in section two and three. Subsequently, section four details the research methodology establishing the data collection and analysis process while section five presents the study results. Section six presents the model development process. In section seven, discusses the findings of the study creating more insights, on the drivers' and factors and their relative importance for further understanding. Finally, the study presents the conclusion on main findings of this research in section eight.

2. Cost Management in Construction Projects

Cost management is key 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 et al., 2006; Ashworth, 2010). It involves an understanding of how and why costs are incurred on the project while proactively taking the necessary actions in light of all the relevant information. Many private and public sector clients are beginning to recognise the need for effective project cost management given its benefits in achieving effective cost performances, improved value for money and client satisfaction, amongst others (Smith, 2014; Gopalan et al., 2015). As a further step, public clients in some countries like the United Kingdom have developed comprehensive cost management frameworks to guide organisations involved on public sector projects achieve effective project cost performance (United Kingdom office of government commerce, 2007). Though such guides may not widely found in many developing countries, many housing agencies and ministries are unrelenting to develop similar contextual and appropriate guidelines.

An effective CMS is pivotal for effective project cost management (Jacomit, et al., 2011). A CMS is a management system required to accurately estimate, plan, monitor and control project cost within the approved budget (Kern et al., (2004). It comprises of a technical, process and control parameter. The technical parameter embodies a variety of techniques such as operational cost estimating, target costing, and value engineering, to mention a few. The process parameter constitutes four main stages; setting, planning, budgeting and control where the techniques are employed. While the control parameter embodies factors that facilitate and provides the feedback needed for active moderation of the techniques and process. The CMS parameters are depicted in Figure I.

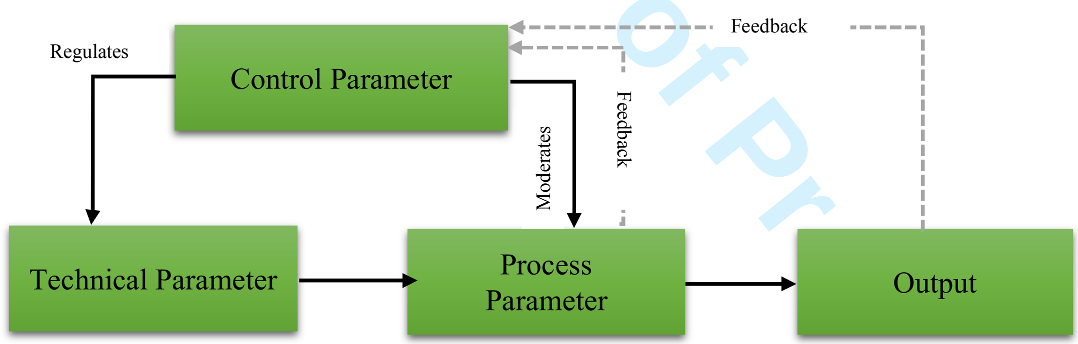

Figure I: Process view of a CMS
Source: Adapted from Sanvido (1988) and Windapo, (2013)

Studies (Windapo, 2013; Sanvido, 1988) shows that the consideration of the factors in the control parameter is critical for successful CMS implementation. The factors ensure successful regulation of techniques, moderates the process and provides feedback to examine the output of each process stage against certain predetermined performance pointers. Hence, though, technical considerations are important, the implementation factors are not ignorable.

Following propagations for the adoption of effective CMS on LcH projects various models have evolved showing viable techniques for improvement. A framework for LcH project cost management in Nigeria developed by Oladapo (2001), identified value engineering. Kern, et al., (2006) develops an integrated CMS model applicable to LcH project delivery in the Brazilian housing context highlighting the integration of target costing, s-curve, and operational cost estimating techniques. Similarly, Jacomit, et al. (2011) develops the Target costing framework for LcH project delivery in Brazil highlighting the integration of target costing technique. Similarly, Obi, et al. (2015) recommends the adoption of target value design technique to improve CMS performance in LcH project delivery in Nigeria. Findings from the three recent studies advocate for implementation of modern CMS in LcH project delivery. However, they considerably ignore the success factors necessary for the effective CMS implementation. The lack of extensive studies in this area could be one of the many reasons affecting effective CMS implementation particularly in the context of LcH project delivery in Nigeria.

Evidence show that a list of success factors for CMS implementation are rare in construction literature. A few studies such as Tang (2005) and Olawale et al., (2010) on construction projects delivery in the United Kingdom and Hong Kong respectively highlights effective management actions as a key success factor. Nevertheless, their findings were limited to the study context and particularly not peculiar to LcH project delivery. Hence, the need for a contextual investigation on the success factors needful for effective LcH project CMS implementation in Nigeria which is what this study has set out to achieve.

3. Success Factors in Construction Projects

Success factors as defined by Chen, et al., (2011) are the important elements of a management system that leads directly to the successful outcomes. In this context, it implies the essential factors of the control parameter required to maintain viable implementation within the CMS. Review of extant studies shows that success factors could be management, human, project environment and procurement related. Extant literature documents a variety of drivers' associated with these success factors. 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 et al. (2005), Arcilia (2012), Hwang et al. (2012), and Kog et al. (2012), identified the key drivers' for effective cost performances. While Tang (2005) and Olawalet et al. (2010), identified key drivers' for project cost management. Similarly, in the Nigerian context, Ogwueleka, (2011), Amade et al., (2015), and Okoye et al. (2015) identified 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 1.

A critical view of the studies mentioned above, apparently shows a consensus on 13 specific salient drivers' for project cost performance and management. These drivers' are mainly associated with human, management and project environment related success factors. According to Olawale et al., (2010) human and management related success factors are apparently more persistent and require continuous management in comparison to project environment related success factors. Based on this discovery, this study reviews and summarizes the literature supporting the 13 identified drivers'.

Availability of cost data

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. Akintoye (1998 cited in Tang, 2005) and Tang (2005) pointed out that this driver guides the estimator's judgment in improving the accuracy of current estimates. Hence, availability of cost information is necessary for cost-effective planning and estimating.

Adequate designs and specification

According to Shrestha et al., (2013) government fund public projects, i.e., LcH from taxes; hence it is necessary that the government complete the projects within a reasonable cost. This driver is critical for project cost control, particularly at the construction stage.

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 project team to precisely program and documented deliverables, schedule and to monitor real-time progress including site resources control (Haughey 2014). Hence, the team commitment to viable methods for effective project planning and supervision (control) is needed.

Competent project team professionals

Competence refers to the degree of skill, knowledge, and experiences of the team members (Association of Project Managers (APM), 2015). The PMT need to be wholly competent, qualified and experienced in their professional roles as well as specific roles affecting the CMS (Alexandrova et al., 2012). These quality influence the level of effective implementation of techniques and process in the CMS.

Early Contractor Involvement

The contractor's tacit knowledge from similar projects is a useful input that can influence the CMS positively (Song et al., 2009; International Association of Dredging Companies (IADC), 2011). Therefore, the contractor's early involvement can facilitate viable contributions, fosters better cooperation between the contractor and other PMT throughout the cost management process. Hence, enhances strategic decisions that can influence project planning, designing, and control in a cost-effective manner to deliver the best value to the client.

Effective collaboration and commitment of the team

Collaboration is characterised by mutual trust, communication and coordination (Mistry et al., 2009). It involves teamwork, two-way communication, information and knowledge sharing to effectively accomplish both individual and project focused tasks (Mishra et al., 2009). Therefore, this driver can facilitate generation of viable ideas needed to achieve predetermined process performance pointers.

Clear and well-detailed Client Project Brief

A client project brief defines the strategic project outcomes, objectives, requirements and target market (APM 2015). A clear, detailed brief provides the PMT with a good idea of client's project expectations and guides in the specific choice of process approach that can deliver to client satisfaction. Therefore, this driver is needful for effective project cost planning.

Constructability

It emphasises the importance of construction input and recognises the principles of construction that facilitate the realisation of the project objective (Arcilia, 2012; Kog et al., 2012). It benchmarks the optimum use of construction knowledge and experience in planning, engineering and field operations. Therefore the method of construction can influence the approach to cost management on the project.

Effective Risk Management

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

Budget update

In achieving effective project cost control, the PMT must be aware of any changes in the cost baseline and ensure that such changes are coverable by the contingency cost to cover small budget modifications. The budget update involves appraising approved changes in the budget that affect the cost baseline used to monitor and control project costs (Arcilia, 2012).Therefore, mitigating unnecessary project expenses require monitoring and effective project cost control through budget updates.

Adequate and effective Cash flows

Effective cash flow is vital to successful project delivery (Usman et al., 2016). It is the actual movement of money in and out of a project. The effective and timely flow of money into the LcH project is one of the key client's obligations (Saisi, et al., 2015) to assist the PMT, mainly the contractor, maintain workflow necessary for effective project cost control.

Stable Economic Environment

Declining revenues, rising debts, and fiscal shortfalls are all triggers of economic instability. The general economic activity affects the construction environment (Akanni et al., 2015) and studies on periodic economic cycles, forecast of economic trends both local and global are not holistic solutions. Therefore, a stable economic environment is important for construction market stability and adequate money circulation that can affect the management of the site resources.

Stable weather conditions

The weather is not easily and accurately predictable. Torrential rains as found in tropical regions is such that it causes wasting material resources at the LcH project site and affecting construction cost control (Ihua et al., 2014). Since it does not appear realistic to control the weather, factoring possible alternatives in project planning is necessary to cushion the adverse effects.

The findings from the above review clearly indicate that many of the identified drivers' are human and management related success factors in comparison to project environment related success factors. This finding suggests that human and management related success factors 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. This result creates the need for further contextual investigations.

4. Research Methodology

The researchers have an interpretivism perspective which involves constructing and creating knowledge based on collective opinions of experts and participants (Fellows, et al., 2015). The study employs both questionnaire and brainstorming sessions to gather contextual information on CMS for LcH project delivery from selected PMT experts in Nigeria. Adequate caution ensured that the target PMT participants were quantity surveyors, architects, project/ construction manager and engineers who by their educational and professional background are considered knowledgeable in the area of project cost management. The methodology process comprised three main phases as illustrated in Figure. II.

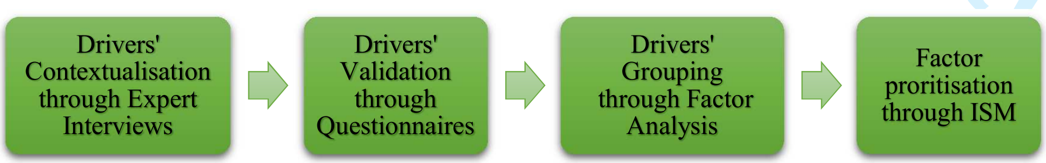

Figure II: Research methodological framework

A brainstorming session was conducted with six PMT members two each from the housing agency supervision team, the consultancy team, and contractor's management team. The researcher compiled a list of the drivers' identified from the literature and presented it to the experts explaining the research concept, context and the purpose of the questionnaire. The feedback from the experts eliminated constructability and effective risk management, integrated budget update into effective project planning and supervision, and added an adequate resolution of land compensation issues and political stability. The findings enabled the development of the final version of questionnaires. Consequently, 249 questionnaires were administered to PMT members contacted. The respondents were requested to rate on a four-point Likert scale ranging from "very highly influential" to "Not influential" the level of influence of each driver in CMS implementation on LcH projects in the Nigeria. The purpose of the survey was to confirm findings from the first phase by a wider pool of PMT experts. The Factor analysis (FA) is used to analyse the findings from the questionnaire. FA is a statistical set of techniques applied to reduce a larger set of variables/drivers' into a smaller set of principal components, or Factors that account for most of the variance (Pallant, 2013). Thus, FA offers not only the possibility of gaining a clear view of the data but also using the output in subsequent analyses (Pallant, 2013). Past studies such as Xu (2011) have employed the FA to analyse success factors. In this study, the FA examines the identified drivers' needed for successful CMS implementation and groups them into factors. This analysis was facilitated using Statistical Package for Social Sciences (SPSS) software. After that, ISM technique is employed to understand the relationships between their drivers' and emerging factors.

The ISM is a modelling technique, in which the specific relationships and overall structure of drivers' are portrayed in a digraph model (Sharma et al., 2014). It helps to impose order and direction on the complexity of relationships among various elements of a system (Sage, 1977 cited in Attri et al., 2013; Singh et al., 2003). Since its development in 1974, the ISM has since become a computer-aided method for developing graphical representations of system composition and structure. The ISM methodology involves the development of a structural and reachability matrix, followed by a level partitioning used to produce a diagraph and finally a classification and categorisation analysis. Six PMT experts who were involved in the first phase brainstormed on the results of the FA. Based on their views, the ISM diagraph and driver power-dependence matrix is determined giving valuable insights into the relative importance and interdependencies among the drivers'. The findings from the ISM facilitated the development of the success factor model presented in this study.

5. Analysis and Results

5.1 Demography of Respondents

The researcher administers 249 questionnaires. A total of 144 questionnaires were completed and returned accounting for 57.83 per cent response rate. The frequency distribution of total respondents show 26 respondents (18.1 %) representing the housing agency project team, 57 respondents (39.6 %) representing the consultancy team and 61 respondents (42.4 %) representing the contractor's team (Table 2). Further analysis of their work experience reveals that 89.6 per cent of the respondents possess relevant knowledge and expertise in project cost management on low-cost housing projects.

5.2 Factor Analysis Output

The 13 drivers' were subjected to FA using the principal component analysis (PCA). Before the test, the researcher ascertains the suitability of employing FA using the indicators identified in past studies (Kumar 2015; Osborne et al., 2009; Rattray et al., 2007). These include the measure of sampling adequacy Kaiser-Meyer-Olkin (KMO)-test value greater than 0.5 which 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. The SPSS results show a KMO of 0.785. 13 variables and 144 participants express a variable ratio of 11: 1. This result indicates the suitability of employing FA in this research context. Furthermore, Osborne et al. (2009) illustrated through their study that 13 variables can be used to perform FA. 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 respectively. However, the scree plot showed a break after the third factor, which suggests retaining three factors (Pallant, 2013). The three-group factor solution explained 66.88% of the variance. Factor 1, 2 and 3 explain for 38.08%, 17.87 and 10.92 % respectively. The varimax rotation was performed twice to represent correlated items with a smaller set of 'derived' groups of factors and aid interpretation. Following these steps, the analyses have resulted in the extracting availability of cost data because it possessed value less than 0.4 leaving 12 items with coefficients more than 0.5, and defining three groups of factors with at least three drivers' (Table 3). From Table 3, 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 loaded on Factor 2 and competent design team professionals, competent contractor site team, early contractor involvement, effective team collaboration and commitment loaded on Factor 3. The FA results show three groups of drivers' emerging to three factors. Given the characteristics of the drivers'' in each group Factor, 1 is named stable operational environment, Factor 2 information, and management actions and Factor 3 effective team qualities (Figure III).

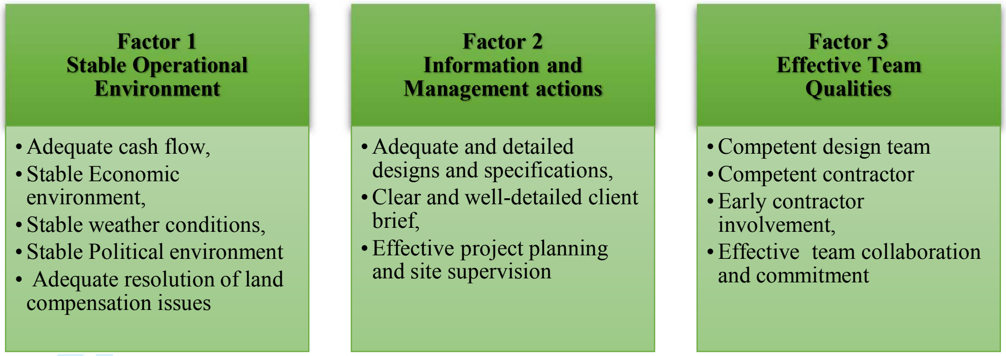

Figure III: Factor analysis result

The FA results show a relationship and commonalities between the drivers' and the factors. In order to effectively develop the success factor model, these contextual relationships need to be explored using the ISM.

6. SUCCESS FACTOR MODEL DEVELOPMENT

Following the FA results, another brainstorming session was conducted with same PMT members involved in the first session. The participants were required to define the relationship between the 12 drivers' using the term "facilitates" for links. Their views were used to develop the structural self-interaction matrix (SSIM). Consequently, the SSIM is converted to binary values to develop the initial and final reachability matrix. Table 4 documents the final reachability matrix (FRM). From the FRM the level partitions are established. These partitions are assigned following iterations process of the drivers' (Table 5). 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) a level is established. From the Level partitions, the ISM diagraph (Figure IV) is developed.

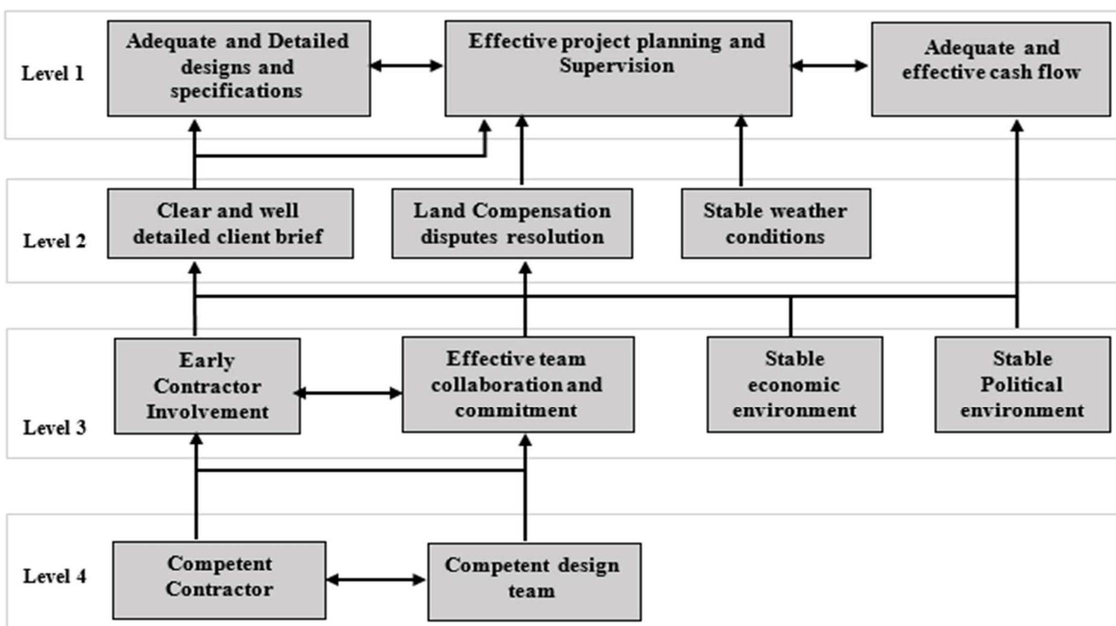

Figure IV: ISM driver model

The relationships depicted in the ISM model, reveals the following:

At Level 4, competent design team (D4) and competent contractor (D5) are located at 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'. At Level 3, four drivers' namely early contractor involvement (D6) and effective team collaboration (D7), stable economic (D9) and stable political environment (D10) are located. 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. At 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. D11 has no connection to the base of the ISM model. All three drivers' have no bilateral relationship, but all directly facilitate effective project planning and supervision (D3) at level 1. Only D1 has a directly facilitate adequate and well-detailed designs and specifications (D2) on level 1. At 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; D3 and D8 have bilateral relationships. These three drivers' depend on all others from the base.

The 12 drivers' are subsequently analysed using the Matriced' Impacts Croises-Multiplication Appliqúe an Classement (MICMAC). The MICMAC categorise drivers' into independent, linkage, dependent, and autonomous clusters. The autonomous cluster contains weak and dependent drivers', though may have a few strong links are relatively disconnected from the system. The Dependent cluster contains weak drivers' with strong dependence. Hence, they cannot function effectively without the help of other drivers' in the system. The linkage cluster contains drivers' that are both strong and dependent. These drivers' are unstable, and any action affects them and other drivers' in the system. Finally, the Independent cluster contains strong drivers' with weak dependence. Hence, they are highly relevant because they possess the capability to influence other drivers' in the 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 FRM in Table 3, for analysis. The MICMAC result classifies the drivers' into three clusters excluding the linkage cluster (Figure V).

	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 V: MICMAC categorisation of drivers'

The MICMAC analysis results show that:

- The drivers' located in the independent cluster are competent design team, competent contractor, early contractor involvement, effective team collaboration, and commitment. These drivers' are considered fundamental drivers'.
- The drivers' located in the dependent cluster are adequate and well-detailed designs and specifications, effective project planning and supervision, adequate and effective cash flow, adequate land compensation and clear and well-developed client brief. These drivers' can be considered as outcome or resultant drivers' because they depend on other drivers' from the base of the ISM model.
- The drivers' located in the autonomous cluster are stable economic environment, stable political environment, and stable weather conditions. These 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.

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. The results from the ISM diagraph show that drivers', D4 and D5 are the most important drivers'. The drivers' at the top of the ISM model D2 D3 and D8 depend on these two drivers' at the base to function effectively. The MICMAC analysis result also clearly show 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. Based on the ISM and MICMAC results, out of 12 drivers' (FA results) nine are influential. Hence, ISM retains drivers' D4, D5, D6, and D7 associated with effective team qualities, D1, D2, D3, associated with effective information and management action and drivers' D8 and D12 associated with stable operational environments. These findings clearly indicates that effective team qualities is a highly influential success factor in the control parameter needed for effective CMS implementation followed by effective information and management action and lastly stable operational environments. This information is subsequently used to develop the success factor model shown in Figure VI.

Figure VI: Representation of success factor model in the CMS

7. Discussion of Findings

The study results reflect the current views of the PMT on the success factors needed to improve effective CMS implementation in LcH project delivery in Nigeria. The FA groups thirteen validated drivers' into three success factors namely effective team qualities, information and management actions and stable operational environment. The ISM further structures a hierarchy relationship of the drivers' which aids the design and development of the success factor model. From the study findings, effective team quality is the most important success factor that facilitates effective CMS implementation followed by effective information and management actions and lastly stable operational environment. The relationship of these success factors as depicted in the model shows that an effective team quality directly influences effective information and management actions and indirectly affects the stable operational environment that. To improve the CMS in LcH project delivery in Nigeria, both project sponsors and project manager must consider these three factors.

An effective team quality is a key success factor in CMS implementation. This success 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 can achieve expected performance outcomes. This factor is a human related success factor highlighted in past studies by Mishra et al., (2009); Song, et al., (2009), Amade et al., (2015) and Okoye, et al., (2015); as most influential on management performances which this study further confirms. As espoused by Palmer (2014) without the right team in place, any strategy or plan has the potential of completely falling apart. In Nigeria, difficulty accessing cost data for estimating accuracies and poor decisions of the quantity surveyor are problems affecting project cost management. With early contractor involvement and better collaboration (trust, coordination, and communication), the knowledge and experience of PMT members can be harnessed. The PMT can adequately brainstorm information from cost feedback of previous and other relevant information before implementation. This process results in strategic cost decision in the setting, planning, and budgeting and control process before implementation to deliver the best value on the project. Hence, the project sponsors and managers must exercise caution in ensuring that members of the PMT are knowledgeable experienced and collaborative to supporting the objective of the project and meet client expected cost performance outcomes.

The second influential factor is effective information and management actions. The drivers' of this factor include; detailed Project designs and specifications, Clear and well-developed client project brief, Effective project planning and Supervision. This management related success factor as supported by findings in past studies by Shrestha et al. (2013) Amade, et al. (2015) amongst others is ranked as highly significant. However, in this study it is the second influential success factor. Clear client brief identifies the requirements for the project regarding cost and value. This detail guides the development of adequate and detailed designs and specifications leading to cost effective targets for each element of the building. With the cost targets, effective planning and supervision of project activities and onsite resource control during construction is proactive. This result will help in monitoring real time progress, report, and documented deliverables and produce the cost performance report. Therefore, in implementing effective CMS viable information and management actions, makes the PMT undertake a smooth cost estimating planning and control process.

The third factor is a stable operational environment with adequate and effective cash flow and adequate resolution of land compensation issues as key drivers'. This agrees with Akanni et al., (2015) who stated 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. This success factor is of least influence on CMS implementation in LcH project delivery in Nigeria. 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. This result implies that focus on this factor by the PMT on it should be relatively minimal. However, its impact cannot be ignored. The lack of working capital to support daily site activities can be a problem in LcH project delivery affecting efficient cost control. For instance, the funding agencies are a separate institution from the housing agencies and the inefficiencies and bureaucracy of the funding agencies affect cash flow. Similarly, appropriate procedures to ensure adequate land resolution that leads to project delay and vandalism can affect cost control. Hence, a call for an adequate project financing and negotiating mechanism be put in place by project sponsors as these drivers' are beyond the control of the PMT. Though the PMT can also provide useful recommendations that can assist the project sponsors in strategic decisions 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.

Based on the findings this study agrees with past study findings and concludes that human and management related success factors are most important to be considered for effective CMS implementation than project environment related success factors.

CONCLUSION

This study develops a success factor model to facilitate effective CMS implementation in LcH project delivery in Nigeria. The study reveals that the factor most important for successful CMS implementation is effective team qualities. This factor embodies competence, composition, collaboration and commitment of the PMT. The second important factor is effective information and management actions comprised of clear and well-detailed client project brief, detailed designs and specifications and effective project planning and supervision. The third factor is a stable operational environment, comprising of adequate and effective cash flow and adequate resolution of land compensation issues as key drivers'.

This research found out that an effective team quality is highly critical in CMS implementation in LcH project delivery in Nigeria. Therefore, there is need to ensure that the members of the PMT are knowledgeable, have the required educational and professional backgrounds as well as similar experiences in the roles they will be assigned before they are engaged on the LcH project. It is also important that they have the capacity to work collaboratively throughout the cost management process for appropriate choice of techniques and moderation of the process to achieve the expected system outcomes. This operation will give room for better information and management during the cost management process.

The results of this research have several implications for the Nigerian LcH sector. One of the implications is that the project sponsors and project managers need to assess the competence of members of the PMT before engaging them on the project. Secondly, the adoption of a procurement system that will facilitate full team collaboration throughout the project delivery process can be of advantage. In a case where such procurement system is not adopted, special arrangements should be made to engage the temporary services of the contractor at the earliest stage of the cost management process. Thirdly, the PMT members should understand that their competency is critical in CMS implementation hence continuous professional development should be an unrelenting effort. Fourthly, where necessary, the PMT should be willing to give professional advice to help project sponsors in strategic decisions to facilitate stable operational environment.

Furthermore, this research has made some significant original contributions, in the area of success factors for CMS implementation. Although there have been, previous research in CMS improvement for LcH project, none have attempted to identify the success factors necessary for its effective implementation into a cohesive model. The findings of this research are significant, but one of the major limitations is its applicability only to LcH projects in Nigeria. Hence, for the generalisation of the factor model to any other project type or geographical context will require further investigations.

Finally, the study recommends that future studies can use the research findings as a platform to investigate each driver identified with respect to the cost management process stages or performance pointers using other modelling techniques such as the Interpretive ranking process. The study also identifies other drivers' of a stable operational environment considered of least importance in CMS implementation that may have a significant impact on the overall project uncertainty, hence a path for further investigations.

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PRIORITIZING COST MANAGEMENT SYSTEM CONSIDERATIONS FOR NIGERIAN PROJECTS

Table 1: 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 et al. (2012)	Kog et al. (2012)	Ogwueleka (2011)	Tan et al.(2011)	Olawale et al (2010)	Saqib et al. (2008)	Iyer et al (2005)	Tang (2005)	Pinto et al. (1987)	Chua, et al. (1999)
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 authors from publications

PRIORITIZING COST MANAGEMENT SYSTEM CONSIDERATIONS FOR NIGERIAN PROJECTS

Table 2: Respondents Statistics

Category of PMT	Number of questionnaires distributed	Number of questionnaires returned
Housing agency supervision Team	30	26
Consultancy Team	93	57
Contracting Team	126	61
Total	249	144

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Table 3: 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 land compensation to communities	**.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.

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Table 4. Final reachability matrix

Drivers		D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	**Drivers**
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	0	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	D4	1	1	1	1	1	1	1	1	0	0	0	1	**9**
Competent Contractor 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**
Adequate resolution of land compensation issues	D12	0	0	1	0	0	0	0	0	0	0	0	1	**2**
Dependence		**7**	**7**	**12**	**2**	**3**	**4**	**4**	**9**	**2**	**2**	**1**	**7**	**60**

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Table 5. Level partitions

	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