CONTRIBUTION OF UNIQUE FEATURES OF MASS HOUSING PROJECTS TO PROJECT TEAM COMMUNICATION PERFORMANCE

By

KWOFIE, EBENEZER TITUS - MPhil. Housing Studies

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Doctor of Philosophy in Construction Management

CERTIFICATE OF ORIGINALITY

I hereby declare that this thesis submission is my own work towards the PhD and that, to the best of my knowledge, it contains no material previously published by another person nor material which has been accepted for the award of any other degree of the University, except where due acknowledgement has been made in the text.

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DEDICATION

This piece is dedicated with the deepest respect and honour to Chantelle Peniel Ellis-Kwofie, Titus Otoo Ellis-Kwofie, Florence Jaden Ellis-Kwofie and my lovely and understanding wife Cynthia Fosuah Kwofie for their support, understanding and immense contribution to my life and education.

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God richly bless you.

ABSTRACT

Several studies exploring delivery success on mass housing projects continue to cite communication ineffectiveness inherent in the unique attributes of mass housing as a major problem plaguing the delivery efforts. However, these notable studies fail to empirically establish the nature and extent to which the observed communication ineffectiveness are attributed to the unique features displayed by mass housing projects. In the light of mass housing approach being adopted as a veritable delivery strategy among developed and developing countries coupled with the significant role effective communication plays in project performance and success, the need to engender effective communication in mass housing delivery has engaged the attention of stakeholders in recent times. In the light of this recognition, emerging literature still continues to bemoan the lack of collaborative team effectiveness and delivery failures that are as a result of ineffective communication particularly on projects of unique particularities and characteristics such as Mass housing projects (MHPs). Against this background, there is a common assertion that, the knowledge and clear understanding of the extent and nature of communication ineffectiveness inherent in the unique features of mass housing projects will be a vital resource that can stimulate the effective planning of MHPs. Additionally, this understanding will thus be useful in the adoption of procurement strategies, decision making, communication management, skill development and contract design necessary to influence the needed communication performance among the project participants and stakeholders on MHPs. With the paucity in earlier studies and knowledge gap identified, this study has been undertaken to empirically determine the contribution of the unique features of MHPs to communication ineffectiveness among the project team in its delivery. By adopting the attribution theory of communication performance supported by the 'Hofstede's cultural framework' on communication in project teams, external and internal factors were identified as the two main 'causal locus' attribution of communication performance outcome among the project team. This led to the development and adoption of appropriate theoretical concepts and framework which draw on the attribution theory, communication performance model and the unique features of MHPs. This subsequently established the conceptual evaluative measurement model for the study. By focusing on the external factors herein being the unique features of MHPs, a quantitative research

methodology was employed in investigating the primal contribution of the unique features of MHPs to the project team communication effectiveness. Through the use of Structural Equation Modeling (SEM) as the analytical approach to assessing communication ineffectiveness, the results revealed

Multiple Construction Sites Management Style, Multiple Geographical Location for Various Schemes and Network of Procurement Systems as the unique features that significantly contribute to information flow communication ineffectiveness. Likewise, the *Multiple Construction Sites Management Style, Housing Unit Design Contract Packaging, Network of Procurement Systems and Repetitive Tasks Management Delivery Strategy* features were found to significantly induce information composition related communication ineffectiveness. From the results, it revealed that the unique attributes of MHPs induces about 70.4% of the variance in information composition communication ineffectiveness. In respect of information flow communication ineffectiveness, a variance of about 57% was due to the influence of the unique characteristics of MHPs. These findings have empirically affirmed that, the causal influence of the unique attributes of MHPs to communication ineffectiveness cannot be ignored or underestimated in MHP delivery. It further informs the need for project teams and stakeholders on mass housing to deviate from 'all-fit all' approach and develop bespoke approach to engender communication effectiveness on MHPs. It also provides insights into the mass housing unique features related communication ineffectiveness among the project team thus providing crucial knowledge necessary towards adapting suitable communication planning, management strategies, concepts & approaches, methods and media, that fit the mass housing project environment to engender managerial and communication efficiencies in mass housing delivery.

Keywords: Mass housing project, communication ineffectiveness, unique project features

LIST OF PUBLICATIONS

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Adinyira, E., Ahadzie, D. K. and Kwofie T. E. (2013) Determining the Unique Features of Mass Housing Projects (MHPs). (In: A/Prof Samuel Laryea, Dr Sena A. Agyepong, (Eds) Procs **4th West Africa Built Environment Research (WABER) Conference**, 12-14 August 2013 Accra, Ghana, pp. 381-390.

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Kwofie T. E., Fugar, F., and Adinyira, E. Modelling the Effect of Housing Design Unit Contract Packaging on Mass Housing Project Team Communication Performance'. **Journal of Construction in Developing Countries, (in-press)**

Kwofie T. E., Adinyira, E., and Ahadzie, D. K. 'Influence of Procurement Systems on Mass Housing Project Team Communication Effectiveness'. **Journal of Construction Engineering, (in-press).**

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ANOVA	- Analysis of Variance
BOQs	- Bills of Quantities
CEE	- Concurrent Engineering Elements
CFA	- Confirmatory Factor Analysis
CFI	- Comparative Fit Index
CII	- Construction Industry Institute
CPMs	- Communication Performance Measurements
EFA	- Exploratory factor Analysis
EQS	- Equations Software
GFI	- Goodness of Fit Index
GLM	- General Linear Modeling
GREDA	- Ghana Real Estate Development Association
HDP	- Housing Unit Design Contract Packaging
ICT	- Information Communication technology
INHP	- Iraq National Housing Policy
KMO	- Kaiser-Meyer-Olkin
MANOVA	- Multivariate Analysis of Variance
MCS	- Multiple Construction Sites Management Style
MGL	- Multiple Geographical Location for Various Schemes
MHPs	- Mass Housing Projects
MR	- Multiple Regression
MV	- Missing values

NPS	- Complex Network of Procurement Systems
PC	- Project Categorization
PCA	- Principal Component Analysis
PMC	- Project Management Concept
PMI	- Project Management Institute
PT	- Project Team
PTCE	- Project Team Communication Effectiveness
RDS	- Repetitive Tasks Management Delivery Strategy
RMSEA	- Root Mean Square Error of Approximation
SEM	- Structural Equation Modeling
SHC	State Housing Company
SPSS	- Statistical Package for Social Science
SSNIT	- Social Security and National Insurance Trust
SRMR	- Standardized Root Mean Square Residual

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CHAPTER ONE

CHAPTER ONE

1.0 GENERAL INTRODUCTION

1.1 CHAPTER OUTLINE

In this chapter, the overview and context of the thesis in terms of the study background and the problem statement of the research to be addressed is outlined. The summary of methodology, research objectives, the significance of the study and the scope of the research are also presented. Further to this, the contribution of the study to knowledge as well as the organisation of the thesis are also elucidated in this chapter.

1.2 BACKGROUND TO THE RESEARCH

Communication is considered among the most traditional and emerging critical factors for success in construction project management practice. It is also perceived as the fuel that significantly contributes to the project running smoothly as well as the glue that holds a project team together (Goudar, 2010; Cheung *et al.*, 2004). During a building project, achieving coordinated results and understanding the needs of the project team greatly depends on the effectiveness of the communication (Watson and Gallagher, 2005). Additionally, the recognized positive relationship between project team communication effectiveness and project success (Ingason and Jónasson, 2009; Henderson, 2008), makes attaining effective communication on construction projects a sine qua non. It is also perceived as the 'central nervous system' of project organizations ensuring that project processes progress smoothly (Drinkwater, 2007).

Inspite of these recognitions, ineffective communication has remained a critical challenge confronting construction delivery. This is evidenced by the dominance of the subject in emerging researches (Gunhan *et al.*, 2012; Hoezen *et al.*, 2008; Dainty *et al.*, 2006). In the view of Wikforss and Alexander (2007), the effective performance needed in the construction industry is often affected by ineffective communication and one reason attributed to the causes of ineffective communication is the nature and unique attributes of construction projects. Arguably, construction projects are increasingly becoming more complex, multi-faceted and technically inclined, involving multi-disciplinary and interrelated tasks performed by groups or organisation during the various phases of the construction process (Senescu *et al.*, 2010; Liu, 2009). This makes the construction process a collaborative activity requiring inputs from many groups which form the project team. Additionally, construction project teams form complex relationship and complex communication environments which must be guided and integrated into the planning if effective communication is to be achieved. Hoezen *et al.,* (2008) emphasized that the quality of the communication experienced on construction projects is crucial to attaining acceptable level of efficiency and effectiveness of the construction process. Hence as projects get more complex, achieving and maintaining effective communication among the key players becomes more problematic (Dainty *et al.,* 2006).

However, it is strongly asserted that, with the varied nature of construction projects, there is the need to align management intuitions, communication strategies and planning concepts to suit the nature and attributes of project to engender effective outcomes (Archibald, 2013; Archibald and Voropaev, 2003). This recognition is underpinned by the fact that, given the varying attributes of construction projects, there is the need to shift from the ‘all-fit all’ approach to that of specific project (Sauser *et al.*, 2009; Shenhar, 2001). Additionally, Sauser *et al.* (2009) and Archibald and Voropaev (2003) affirmed that the root causes of project failure are often not technical but mostly due to the problem of the inability of management team to select and adapt the most suitable delivery approach that suits the specific project characteristics and features. All these notwithstanding, most studies on communication in the construction industry have tended to focus on traditional ‘one-off’ building projects (see Xie *et al.*, 2010; Liu, 2009; Dawood *et al.*, 2002; Xie, 2002; Xie *et al.*, 2000; Thomas *et al.*, 1998). The inadequacy in these studies is the limitation in its generalisation and application to all project typologies such as mass housing projects.

Mass Housing projects[1] (MHPs) share unique features and attributes that make their management inherently more difficult in comparison to 'one-off' traditional projects (Ahadzie *et al.*, 2007; Khanzadi *et al.*, 2008; Zairul and Rahinah, 2011). Ahadzie *et al.* (2007) emphasised that the unique attributes of MHPs require distinct management approaches and skills in its implementation to engender success. Likewise, these perceived unique features and attributes of MHPs have implications on the operational, organisational and managerial actions during the construction process (Ahadzie *et al.*, 2007; Yi *et al.*, 2002; Cho *et al.*, 2009). As noted by Roy *et al.* (2003), MHPs have become natural choice for large scale housing for meeting the housing needs of many developing countries and an attempt at improving its management will ensure improved delivery and success. Inspite of

[1] 'Mass Housing Project' (MHP) is defined as: 'the construction of standardized, multiple, repetitive domestic type house-units usually in the same or several geographical location executed within the same

this, ineffective communication among mass housing project teams continues to be the dominant plaguing challenge militating against their success and team effectiveness especially in developing countries (Ibem *et al.*, 2011; Zairul and Rahinah, 2011; El-Saboni *et al.*, 2008; Enhassi, 1997). Additionally, Ahadzie *et al.* (2014) intimated that, unique attributes of multiple site and large geographical nature perculiar to mass housing projects present immense communication and documentation challenges in its management and delivery especially among the project team.

It is affirmed that, the emerging varied attributes of mass housing projects and its project environment, require timely transmission of information and communication as vital to effectively coordinate and accomplish the projects goals successfully (Zairul and Rahinah, 2011; Yan, 2009; Anumba *et al.*, 2007). Even though there is an open admission that the unique nature of mass housing projects influences the ineffective communication performance, the contribution of the unique features to project team communication performance remains to be interrogated empirically. In many studies on the subject of communication performance, researchers have tended to focus on how to improve the communication based on technological developments, information flows, communication media, information and communication technologies (ICT) etc (see Xie *et al.*, 2010; Liu, 2009; Xie, 2002; Mead, 1999). A clear understanding of the relationship between MHP attributes and communication performance is crucial in developing and adapting bespoke strategies & planning and management approaches for successful mass housing delivery.

1.3 STATEMENT OF THE PROBLEM

Poor communication and coordination among project participants, ineffective monitoring and lack of feedbacks remain a critical challenge on Mass Housing Projects (MHPs) (Ahadzie *et al.*, 2014; Ibem *et al.*, 2011; Enshassi *et al.*, 2009; Enshassi, 1997). These challenges in effective communication limit the ability of project teams in achieving stakeholder goals on MHPs. Continually, ineffective communication is cited as being prevalent among project teams on mass housing projects resulting in considerable amount of unproductive time and delivery failures (Ibem *et al.*, 2011; Ahadzie and AmoaMensah, 2010; El-Saboni *et al.*, 2008; Enhassi, 1997). It is also affirmed that, the communication ineffectiveness on mass housing is largely inherent in its unique attributes and characteristics (Ahadzie *et al.*, 2014; Ibem *et al.*, 2011; Enshassi, 1997). However, the extent and nature of the induced ineffective communication inherent from the unique attributes of MHPs still remain empirically unknown. Interestingly, the need to improve the operational, organisational and managerial effectiveness in mass housing delivery through enhancing communication effectiveness has increasingly become a paramount necessity in recent times (Ibem et al., 2011; Zairul and Rahinah, 2011). Hence, a clear understanding of the unique attributes of MHPs and their empirical implications for management and communication will be critical towards improving effective communication performance on mass housing delivery.

1.4 AIM AND OBJECTIVES OF THE RESEARCH

The aim of the study is to investigate the influence of project features on project team communication performance on mass housing projects (MHPs). This broad aim would be achieved through the following specific objectives:

- To empirically establish the unique features of Mass Housing projects.
- To identify the communication ineffectiveness (problems) among mass housing project team resulting from the impact of the unique features.
- To develop a model for evaluating the contribution of unique features of mass housing to project team communication ineffectiveness.
- To empirically determine the contribution of the unique features to the overall communication ineffectiveness among the mass housing project team.

1.5 RESEARCH QUESTIONS

In an attempt to address the research problem, the following questions have been formulated to aid the inquiry:

- What are the unique features of Mass Housing Projects (MHPs)?
- Specifically what communication challenges are faced by project teams on mass housing projects?
- How can the contribution of unique project features to project communication ineffectiveness on MHPs be evaluated?
- What is the contribution of each unique feature of MHPs to the overall communication ineffectiveness among the project team?

1.6 SUMMARY OF RESEARCH DESIGN AND METHODOLOGY

According to Cooper and Schindler, (2003), deciding on the most suitable methodology in any research process is the next most critical step after identifying the research questions and the study of literature. The methodology additionally informs the necessary strategies and procedures to be employed in conducting the research agenda. This research approached the subject by using both primary and secondary data. The study began with critical and extensive review of related literature on mass housing projects and project communication performance among project teams. The literature reviewed further helped to preliminarily uncover trends in project categorisation, project team communication and relation with project attributes. This aided in revealing the probable theoretical framework for the study.

Noting that correlation and predictive analysis lean towards the positivist paradigm (Liu, 2009; Ahadzie, 2007; Xie, 2002), the study through the critical synthesis and consideration of the epistemological, ontological and axiological position of the study adopted positivist paradigm as the main philosophical stance for the study. The primary data collection involved the use of a closed ended questionnaire in a survey of identified mass housing project team leaders in Ghana. Further to this, factor analysis and structural equation modelling (SEM) were employed to explore the relationship between the variables from the data collected to meet the research objectives. At the end, validation of the evaluative model for the contribution of MHPs features to project team communication performance was conducted and from this, some specific recommendations were made to improve communication on MHPs.

1.7 SIGNIFICANCE AND BENEFITS OF THE STUDY

This research advances the knowledge and understanding of the nature of MHPs and its influence on communication performance. Through a systematic approach, the study adequately elucidated the unique managerial, operational and organizational features of MHPs that are crucial in ameliorating the communication management and delivery of

MHPs. This can be achieved by adapting the management approach on MHPs to these unique and contextual attributes (Mahdi, 2004; Enshassi et al., 2009).

Additionally, the advancement of the knowledge and understanding of the communication implications of the unique features of MHPs is also important for evolving the right framework and strategies for improving MHP communication performance. Against the background of the significance of skills development and and knowledge in project performance (Hyvari, 2006), clear understanding of the correlation between the MHP features and communication performance among project team would help in identifying the right behavioural skills and technical competencies necessary to engender effective communication for MHPs success.

Likewise, the established nature and extent of communication challenges experienced among mass housing project teams is considered very crucial in stimulating a continuous professional development (CPD) agenda among mass housing professionals and stakeholder. This will undoubtedly, enhance management and communication practices towards improve communication performance among project teams (Y et al., 2002). Also, the elucidated findings in the study will be of immense benefit towards the development of communication technology and media necessary to influencing effective communication performance outcome on mass housing projects. It will also aid the purpose of making clear decision regarding the suitable type of communication technology and media to be adopted.

1.8 SCOPE OF THE STUDY

Construction communication performance measures are contextually driven and the outcomes of such measures are often limited in their generalization across all project typologies. Several studies on construction communication performance measures have primarily focused on various aspects of traditional ‘one-off’ building projects that are perceived to be different in attributes and characteristics compared to mass housing projects. Due to the relative limited researches on construction communication performance measures focusing on mass housing projects, the study focused on the contribution of the unique features of MHPs to project team communication performance.

In particular, the study paid attention to the unique features of MHPs from the managerial perspective (i.e. the physical, organisational and operational features).

In pursuing the research agenda, the focus of attention was on communication performance among project teams on MHPs. In evaluating the degree and nature of contribution of the unique features of MHPs to communication performance among the project team, the assessments were limited to the objective and overall practical experience of the project team leaders managing various MHPs. Hence, the conclusions of the study are therefore based on findings from data collected from the project team leaders managing MHPs in Ghana. The research was also conducted within the scope of mass housing developers belonging to the Ghana Real Estate Develeopment Association (GREDA) which is the umbrella body regulating private housing development in Ghana. The data collected did cover other agencies and organizations engaged in housing development that are not registered with GREDA.

1.9 CONTRIBUTION TO BODY OF KNOWLEDGE

The contribution of the unique features of mass housing projects to communication effectiveness on mass housing projects delivery has often been overlooked. Inspite of the generally acknowledged communication ineffectiveness on mass housing projects inherent in its unique attributes (Ahadzie *et al.*, 2014; Ibem *et al.*, 2011; Enshassi, 1997), studies have focussed on other parameters such as design, delivery strategies, management concepts (Zairul and Rahinah, 2011; Ahazdie and Amoa-Mensa, 2010; Scot *et al.*, 2006). Hence, this study is aimed at bridging the knowledge gap of limited studies exploring the nature of influence of the unique attributes of MHPs to communication effectiveness among the project team.

Additonally, even though the uniqueness of mass housing projects is well acknowledged in literature, there is lack of significant studies aimed at identifying these features. Where there is a mention of this uniqueness of MHPs, it is often disjointed, not well organized and lacking empirical investigation. Here, the study makes a significant contribution by identifying the unique physical, organizational and operational features from a management perspective as well as examining the empirical influence to MHPs team communication performance.

1.10 ORGANISATION AND STRUCTURE OF THE THESIS

This study made up of nine chapters has been structured so as to present a logical order to the research investigation, findings and conclusions. **Chapter one** outlines the background to the research including the aim, the problem statement, research questions, the scope of the research, as well as the contribution of the study to the body of knowledge. In the **Chapter two**, an indepth attempt is made to review and highlight the contextual definition

and meaning of Mass Housing and the theoretical identification of the attributes and the features of MHPs. **Chapter three** focused on the concept and elements of the communication process. Subsequently, attempt is made to explore communication performance measures and the critical communication factors among
project teams.

In **Chapter four**, there is a presentation on the development of the theoretical framework of the study. This is operationalized into a conceptual framework underpinned by the attribution theory of communication and 'Hofstede's cultural framework'. The main constructs and factors in the framework are explained in this chapter. In **Chapter five**, the arguments justifying the research design and the methodology adopted for the study are presented. Additionally, the chronological process of adopting and developing the most suitable instrument for collecting the relevant data is also stated. In the **chapter six**, the preliminary organisation and analysis of the data collected are also presented. Appropriate descriptive analysis of the demographic data and statistical analysis of the data on communication problems among MHPs teams are also highlighted. **Chapter seven** focused on the development of the evaluative communication performance model and the discussions of the findings. The model validation process and results are explained in the **Chapter eight**.

Finally, in **chapter nine**, the conclusion to the thesis is presented. It summarises the findings of the study, the contributions made to body of knowledge and practice, recommendations for future studies and limitation of the study. The organization and structure of the thesis is summarised in Figure 1.1.

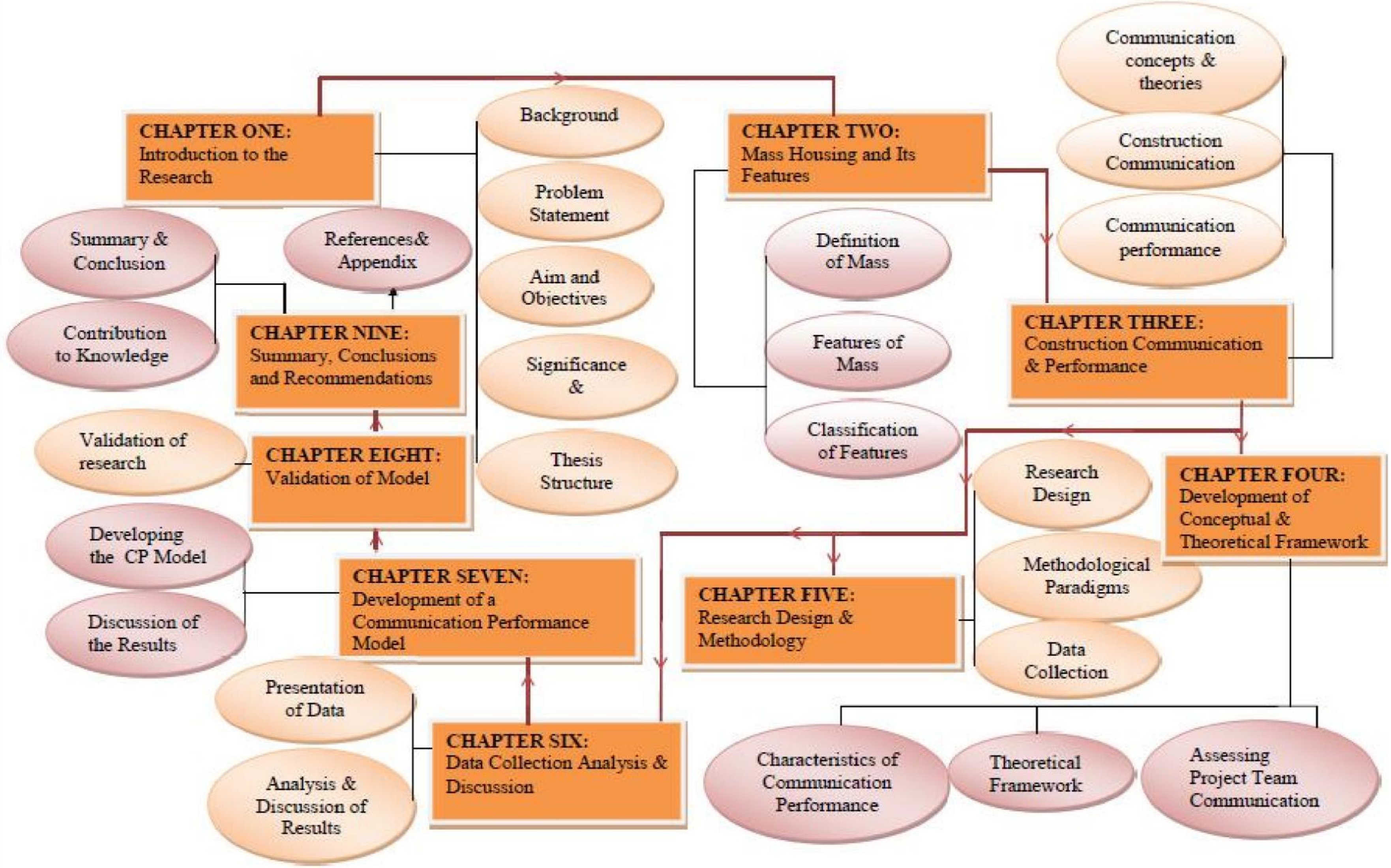
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Figure 1.1: Structure of the Thesis

1.11 SUMMARY

The significance of effective communication and the need to engender effective communication across all project typologies particularly on mass housing project has been explained. Additionally, this chapter has established that, there is a strong perception that, mass housing projects are unique compared to traditional 'one-off' construction projects and this nature significantly induces unique communication challenges. However, a lot of the discussions about this perception have merely been an admission to the assertion. The assertions have also failed to empirically establish the nature and extent of such inherent communication challenges. In the light of this context and foundation, the aim and objectives as well as the scope and study methodology were established for this research. It also espouses the outline of the thesis chapters and limitations of the research.

From the proposed structure of the study, the proceeding two chapters critically review literature on mass housing and its features and communication performance respectively to establish the foundation for the development of the conceptual framework for the research.

CHATER TWO

CHAPTER TWO

2.0 MASS HOUSING AND ITS FEATURES

2.1 CHAPTER OUTLINE

This chapter presents a review of literature on Mass Housing projects (MHPs), its attributes and characteristics. It also provides the necessary theories behind project categorisation and classification leading to the determination of the unique features of MHPs. The contextual definition as well as the characteristics and dynamism of the management trends on MHPs are also presented. The theoretical implications of the review of related literature facilitated the development of appropriate theoretical framework as well as the design of the research methodology.

2.2 CONSTRUCTION PROJECT CATEGORISATION, CLASSIFICATION AND CHARACTERISTICS

The theoretical foundation for project categorization and classification lies in the recognition that it aids efficient management and project success (Sauser *et al.*, 2009; Archibald and Voropaev, 2003; Shenhar, 2001). Hence project categorization and classification have become effective means to facilitate a clear understanding and communication of the attributes of projects among the actors in the field of construction practice. According to Archibald (2005) and Ekholm (1996), construction project classification[2] is essential in specifications, structuring of documents, calculation of project costs etc in other to better manage the project. However, the inadequacy in many attempts

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[2] Construction Project Categorization refers to the system of classifying projects into distinct categories based on specific accepted standards guided by a limited number of attributes (Archibald, 2005).

at categorising and classifying construction projects is the lack of consensus in the concepts and methodological approach.

Generally, many construction organizations and practitioners indeed recognize that, the project they often fund and execute fall within different categories and typologies, however, the project and construction management discipline and concepts have not fully recognized these attributes (Archibald, 2013; Archibald, 2005). The need for construction project practitioners and stakeholders to gain precise understanding and knowledge in project categorization, characteristics and classification has become significantly pronounced in the industry today (Sauser *et al.*, 2009; Muller and Turner, 2007). This is because, such understanding and knowledge is critical to the success of new product development, process improvement, managerial efficiency and performance improvement (Sauser *et al.*, 2009; Shenhar and Dvir, 2004). Sauser et al. (2009) and Shenhar and Dvir (2004) additionally intimated that, issues of project failures are often rooted on the failure to adapt the right and suitable approach and management concepts to the specific project. This is underpinned by the fact that, different project types exhibit different life cycle models, characteristics, and require different methods of governance, prioritizing, authorizing, planning, executing, controlling, resource aggregation and management concepts (Archibald, 2005; Shenhar, 2001).

The term categorization refers to the process of grouping or classifying people, objects, events, and experiences based on common characteristics which members share in a class and distinct features which distinguish these members from those of other classes (Archibald, 2013 & 2005). Classification is also defined as an ordered set of related categories used to group data, people, objects, events and experiences based on its similarities or shared attributes (CSO, 2003). From the two terms defined above, it is clear to note the similarities between them and infact studies have stated that they are the same

(Archibald, 2013; Crawford and Cooke-Davies, 2010; Ekholm, 1996). The study on project categorization has grown rapidly over time witnessing more studies carried out on the concept (see Archibald, 2013; Sauser *et al.*, 2009; Archibald, 2005; Archibald and Voropaev, 2003; Ekholm, 1996). However, despite the overwhelming number of literature on the concept in the present time, there are still some noted paucity in the approach and non-exhaustive nature of the concept as well as the comprehensive understanding of the attributes that determine project categorization (Archibald, 2013; Sauser *et al.*, 2009).

The concept of Project Categorization (PC) has been fundamental to increasing interest in the application and exploration of different project management concepts and approaches (Crawford and Cooke-Davies, 2010). This has sought to challenge the axiom that all projects are the same and thus generic project management concept fits all projects (Archibald, 2013; Sauser *et al.*, 2009; Shenhar, 2001). Bubshait and Selen (1992) studied the relationship between the number of project management techniques (PMTs) used and selected project characteristics and the results affirmed that, PMT are better suited for a project when it matches its complexities and characteristics. Lindvist *et al.* (1998) used a project typology model and demonstrated through empirical analysis that different project organization logics relate to unique 'technological' aspects of the project context.

Also, Floricel and Miller (2001) studied project strategy systems and the results affirmed that delivering high performance in project delivery always require strategic systems that are both robust with respect to anticipated risks and governable traits that are suited to the project type. Similarly, Terwiesch *et al.* (2002) also demonstrated that adopting project planning and management approaches to project typologies yield superior results. Against this, it can be said that these revelations affirm the theoretical perception that construction projects are unique and share unique characteristics and thus delivery approaches must be adapted to these uniqueness and project context.

2.2.1 Theories in Project Categorisation/Classification

The concept of project categorization has been developed from several theoretical perspectives which are often informed by a dominant objective in the approach. A number of theoretical approaches used in project categorization have been developed from the concepts of management, complexities, organizational structures and challenges, physical attributes, product outcome and project environment (see Archibald, 2013 & 2005; Shenhar and Dvir, 2004; Shenhar, 2001; Ekholm, 1996). Over the years, the Contingency Theory and Complexity Theory have been the predominant theoretical perspectives which have underpinned several project categorization approaches.

2.2.1.1 The Contingency Theory

According to Sauser *et al.* (2009), the contingency theory offers practitioners opportunity to continually re-examine the concept of fit between project characteristics and project management practice on a given construction project. Through the use of the contingency theory, several authors have debunked the firm assertion of 'one size fits all' that was thought to underpine all project typologies in earlier project management practice (see Sauser *et al.*, 2009; Shenhar and Dvir, 2004; Shenhar, 2001). The classical contingency theory posists that, different external organizational conditions are experienced and thus in all cases different organisational characteristics are required in project management practice (Sauser *et al.*, 2009; Shenhar, 2001). Hence deriving effectiveness of the organization is contingent upon the goodness of fit between structural and environmental variables on the project (Sauser *et al.*, 2009; Shenhar, 2001). Sauser *et al.* (2009) affirmed that, the contingency approach holds the firm believe that a critical appraisal of the extent of fit or misfit between project characteristics and project management approach must underline the recommendation of the preferred management strategic approach to the project delivery.

Shenhar (2001) further revealed that organic organisation better suits more turbulent dynamic project environment whereas mechanistic organisation thrives with stable and more certain project environment. Youker (2002) also suggested that when projects are grouped based on their product, they share highly similar characteristics and thus similar approaches based on the characteristics is more suitable than generic approaches. Crawford *et al.* (2005, 2004 & 2002) using the classical theory of contingency in project management also affirmed that advancing project management concept based on

categorization of project is more beneficial to organisations. Indeed, the classical theory of contingency perspective hold firm believe that all projects are not the same hence their management approach should not be the same (Sauser *et al.*, 2009).

2.2.1.2 The Complexity Theory

Under this theoretical perspective, the impression created by project management practitioners, underscored by the body of knowledge and practical perspectives, conceive construction projects as invariably complex (Crawford *et al.*, 2005; Geraldi, 2008). Thus affirm that, certain project attributes form the bedrock for evolving the most appropriate managerial actions required to complete a project successfully (Crawford and CookeDavies, 2010; Crawford *et al.*, 2004 & 2005; Dombkins, 2008). According to Crawford and Cooke-Davies (2010), management issues in project delivery among practitioners is always centred on the complexities of their project and that has become a clear manifestation of the practical acceptance that, project complexieties indeed make a significant impact on the management of projects. Crawford *et al.* (2004 & 2005) and Archibald and Voropaev (2003) further revealed that in practice, complex projects often require an exceptional level of management, skill and strategies as conventional systems developed for ordinary projects have been found to be extremely unsuitable.

In this regard, a study by Geraldi (2008) subsequently revealed that the concept of project complexity still persists as an umbrella term associated with difficulties and interconnectedness in project design, delivery and management. Against this, Williams (2002) perceived the characterstics of complex project[3] as encompassing difficulties and uncertainties associated with its organization, design, packaging, operational tasks and management strategies. Crawford *et al.* (2005) on the other hand, revealed that project complexities are often in the uniqueness of the project that requires different procurement, human resource, planning approach to overcome uncertainties. Dombkins (2008) expounding the characteristics of construction project established that there is inherently high degrees of disorder and instability in both the technical tasks and behavioural functions on complex projects. It is also informed that complex projects are extremely sensitive to marginal changes and are typically dynamic in nature requiring very complex evolving systems compared to relatively simple projects (Dombkins, 2008).

However, Whitty and Maylor (2008) opined that the mere presence of project

[3] Complex Projects are project that encompasses extreme difficulties and uncertainties associated with its organization, design, packaging, operational tasks and management strategies (Crwford *et al.*, 2005)

uncertainties of events in the project delivery does not imply complexities on the project. It has further been established that issues relating to phase transition, adaptiveness, sensitivity, emergence and non-linearity to initial conditions are typical complex adaptive systems that are usually associated with complex projects (Girmscheid and Brockman, 2008; Remington and Pollack, 2007). In evolving the complexity characteristics of construction projects, Geraldi (2008), identified '*complexity of fact'* which was interpreted as a situation when participants lack time to fully analyse and understand the related large amount of interdependent information to inform a decision (Geraldi, 2008). Geraldi (2008) and Richardson (2008) intimated that, there is also a '*complexity of interaction'* which refers to neutrality and ambiguity present in interfaces of complexities. To this end, they empirically concluded that, these forms of complexities vary across the project life cycle with complexity of interaction being dominant at all phases (Geraldi, 2008; Richardson, 2008).

According to Baccarini (1996, pp 201), 'project complexity is defined as consisting of many varied interrelated parts and can be operationalized in terms of differentiation and interdependency'. On this score, Muller and Geraldi (2007) added two aspects of project complexities as organizational and technical complexities which are considered very critical management concepts and task delivery approach on the project. The organizational complexity related to *'differentiation'* refers to the number of hierarchical levels, number of units, division of tasks whereas *'interdependency'* entailed the degree of operational interdependencies experienced between organizational elements (Muller and Geraldi, 2007; Baccarini, 1996). In offering clarity to the 'Differentiation' dimension of organizational complexity, Baccarini (1996) posited that Vertical Differentiation (VD) deals with the depth of the organizational hierarchical structure (number of levels). The Horizontal

Differentiation (HD) on the other hand is interpreted as the number of formal organizational units and the division of tasks defined (Baccarini, 1996). Baccarini (1996) however argued that, these must always be adapted to the project based on the critical synthesis of the project complexities in order to engender delivery success. It is also emphasized that, project complexities additionally give rise to technological complexities which refers to the elements of the operations, characteristics of materials and characteristics of knowledge to be adopted on the project (Muller and Geraldi, 2007).

Geraldi (2008) contended that technological complexity related by interdependency usually encompasses the level of interdependencies that exists between tasks and within the network of tasks in the different technologies adopted and between the inputs on the projects. The operational aspect of technical complexities refers to number and diversity of inputs and outputs and the number of different tasks to produce the end product in the operational task functions performed in the delivery process (Geraldi, 2008).

Quiet a significant number of scholars who hold this theoretical perspective to project categorization have empirically acknowledged the importance of complexity in project management to practitioners and stakeholders. Muller and Geraldi (2007) and Bennett (1991) contended that, complexity is very critical and forms an important factor in the successful selection of the most suitable and appropriate project organizational form.

2.2.2 Approaches to Project Categorisation and Classification

In more recent times, several studies have suggested additional frameworks in an attempt to categorize and distinguish between different project types (Archibald, 2013 & 2005;

Crawford *et al.*, 2005 & 2004; Turner and Müller, 2003; Youker, 2002; Floricel and Muller, 2001). This phenomenon offers an array of diversified approach to project categorization in construction and project management practice. Hence the question posed is 'what criteria or project attributes are best used to categorize projects?' Crawford *et al.* (2004) suggested that, it is dysfunctional to try to categorize projects without knowing what purpose will be served by the categorization.

According to Archibald (2005) and Archibald and Voropaev (2003), the method adopted for categorizing a group of projects typically depends on one or more specific attributes. Similarly, Floricel and Muller (2001) previously alluded that classification is more of summarizing and ordering of available knowledge and not to build a theory. It is stated that, the basic concepts in construction project classification must encompass properties that are of interest in the design, construction and management processes (Ekholm, 1996). The challenge often encountered in project categorization is embedded in the lack of an effective response that can select the most appropriate characteristics to define the best categories for a specific purpose (Archibald, 2005). In this regard, Archibald (2005) defines project classification method as the definite procedure applied in the process of identifying the set of characteristics or features that define the project within specific categories. Hence *Market Share & Strategic Intent approach, Project Product or End Result approach* and *Multi-dimensional Classification of Projects approach* have been identified as the three main methods of project categorization and their explanations are given in the next sections.

2.2.2.1 Market Share & Strategic Intent approach

This approach to project classification has been extensively used with the notable one in recent times being by Fern (2005). The study by Fern (2005) combined the Hammel and

Prahalad's theory and matrix relating to market share and market growth by the Boston Consulting Group. In this study, it was postulated that in order to make a useful project categorization, it should provide an appropriate category for any project we may encounter. It should also permit classifications within each category and provide useful insight about differences between projects in each category. Additionally, the projects in every other category must be readily translatable and comprehensible across human cultures in its categories (Fern, 2005).

Fern (2005) and Archibald (2005) contended that, a clear attributes and features based on the product must be identified to distinguish the project categorization. To this end, they contend that the attributes of classification must conform to the three strategic intents of

Technological Excellence (TE), Operational Excellence (OE), or Customer Intimacy (CI). According to Fern, (2005), TE strategic intent offers competitive advantage, OE offers cheaper development cost, efficient manufacturing or production processes, and economies of scale and its attendant benefits to the organization. CI on the other hand makes products more customer-specific.

2.2.2.2 Project Product or End Result approach

Studies such as Shenhar and Dvir (2004), Archibald (2005) and Youker (2002) have well expounded this approach to project categorization. They primarily classified projects by focusing on the product or end results attributes. Drawing on the theoretical perspective of project management practice, this approach to project categorization remains the most significant and dominant. This is because, it is well noted that the type of product determines the type of work involved and hence the best mode and methodology for managing the project (Archibald, 2005; Archibald and Voropaev, 2003). Similarly, Archibald (2005) and Shenhar and Dvir (2004) revealed that, to be able to deliver project successfully, it must be accepted that, different types of projects are associated with different types of product attributes and thus needs to be managed differently.

Youker (2002) similarly opined that, the most important and useful breakdown of project type is by the product or deliverable attributes. Youker (2002) thus established that, product characteristics and features of projects must be distinctly classified without complexities. However, it could be seen that this approach is verily more applicable in the manufacturing sector.

2.2.2.3 Multi-dimensional Classification of Projects

This approach to project categorization was developed based on combining several factors defining the attributes of the project. These factors include the organization style, operational task function, leadership, the nature of the project and the product (Floricel and Muller, 2001). According to Archibald (2005), this sytem must allow practitioners to use the attributes to classify projects into categories and sub-categories. Shenhar and Dvir (2004) and Shenhar (2001) evaluated project typologies and demonstrated that styles differ from project but are usually interlaced to monitoring, evaluation and control of activities and thus require the understanding that different projects are managed differently. They further posited that adapting and blending management concepts and styles to project types enhances performance and reduce delievery uncertainties.

Cho *et al.* (2009) established that, construction projects share unique characteristics which significantly influence the performance outcome. Crawford *et al.* (2004) revealed several multi-dimensional attributes to project categorization and proposed that projects are efficiently managed by adapting the project managers' skills and competencies to the project uniqueness. Manu *et al.* (2010) revealed that construction projects exhibit unique organizational, physical and operational attributes which have implications for their management, health and safety and delivery successes. In this domain, several studies have explored projects categorization by looking at the size, cost, extent of resources, challenges etc as the main attributes (Kipp *et al.,* 2008). In this context, studies alluded that operational and organizational tasks are the main tenets of management practice that is more likely to induce managerial efficiency.

2.2.3 Project Characteristics/Features

Project characteristics[4] are said to provide and underpin the basis for determining the appropriate managerial actions that are required to initiate and control projects successfully (Geraldi, 2008; Crawford *et al.*, 2004). Indeed, it can be said that construction projects exhibit many attributes that determine their uniqueness which often form the basis for defining their classification or characteristics within a specific category (Geraldi, 2008; Archibald, 2004; Crawford *et al.*, 2004). It has been advanced that, the failures of several significant projects, when attributed to technical reasons have rather been caused by managerial inefficiencies that are rooted on the failure to select the right approach to the specific project (Sauser *et al.*, 2009). Hence ensuring managerial efficiency in the delivery of construction projects demands an appreciable level of clear understanding and

[4] Project Characteristics are the attributes of the project or the items which define the technical nature of the inherent tasks and work (Crawford *et al.*, 2004; Geraldi, 2008).

knowledge of the unique characteristics that define construction projects from a managerial perspective.

According to Ahadzie *et al.* (2007), mass housing projects are very unique compared to traditional 'one-off' projects and thus require unique skills and management approach in its delivery. It is well documented that mass housing projects are bedeviled with frequent managerial inefficiencies and communication ineffectiveness which are inherent in their unique characteristics and challenging delivery environment compared to traditional 'oneoff' construction building projects (Ahadzie *et al.*, 2007; Zauril and Rahinah, 2011; Enshassi et al., 2009; Enshassi, 1997). Hence given the aim and crux of the study, the following sections have been structured to focus on mass housing projects.

2.3 TOWARDS THE CONCEPTS AND CONTEXTUAL DEFINITION OF MASS HOUSING PROJECTS (MHPs)

Mass Housing development has globally become the veritable paradigm towards meeting the growing housing demands in many countries (Roy *et al.*, 2003; Turk and Guven, 2008; Kolawole, 2012). Over the past few decades, rapid population increase and growing urbanization have triggered a consequentially rapid demand in housing needs the world over. More especially, developed and developing countries have witnessed a lot of interventions aimed at accelerating housing production and delivery success (INHP, 2010; Syed *et al.*, 2010; Khanzadi *et al.*, 2008). In this regard, several clichés have been used to describe these housing delivery efforts in large quantities such as Mass Production, Commercial Housing, Mega Housing, Multi Housing etc (INHP, 2010; Urban, 2012). All these descriptions have a common denominator, which is the number of housing units involved in such projects though the delivery approaches and concepts differed.

The intent for housing delivery has gone through a lot of revolution since the late 1980s. Yöney and Salman (2010), Yüksel and Pulat (2010) and Pulat and Özsoy (2008) noted that, from the late 1970s to the mid 1980s, housing production has shifted from developing for 'build and rent' to 'build and sell' on 'small production'. Towards the end of the decade housing supply based on “build-and-sell” style in small production had lost its characteristic to be the prevailing supply form (Yüksel and Pulat, 2010; Pulat and Özsoy, 2008). This was replaced by 'mass housing' approach which took the form of development in large quantity of housing units in larger and well-arranged urban parts in many developed and developing countries (Yüksel and Pulat, 2010; Pulat and Özsoy, 2008). To this end, Mass-housing production has made a significant impact in major urban areas in developing countries, becoming the dominant production paradigm in making gains towards reducing the housing demand deficit (Yüksel and Pulat, 2010).

The origin and evolution of mass housing can also be traced in the theories of social reform and standardised construction (Urban, 2012). Against this background, several definitions have been given to the term 'mass housing' in different context (Urban, 2012; Ahadzie *et al.*, 2007; INHP, 2010). While acknowledging that all these definitions indeed imbibe the concept of producing houses in commercial quantities, some fail to also highlight the intrinsic characteristics of the process and the units that make their control, management and production inherently different from the traditional 'one-off' construction projects often encountered in the construction industry.

According to Roy *et al.* (2003), Formoso *et al.* (2002), Dhaneskar (2000) and EL-Rayes, (2000), the term Mass Housing has been used to describe the 'mass production techniques' of housing development projects in the construction industry suggesting no comprehensive definition that encapsulate the grounding of this study. Even though the term 'Mass Housing Projects' (MHPs) has been entrenched in the construction industry, its use and interpretations often differ from one project context to the other. In the light of this, it is extremely pertinent that a more encapsulating definition is adopted to espouse the context of this study. Against this background, in the context of this study, 'Mass Housing Projects' shall be defined as:

> '*the construction of standardized, multiple, repetitive domestic type house-units usually in the same or several geographical location executed within the same project scheme under the same management and contract for either speculative or user defined delivery'* (Adinyira *et al*., 2013)

This definition builds on that given by Ahadzie *et al.* (2007). The deficiency in that was the exclusion of the management and contractual connotation of mass housing projects as well as a new emerging trend of user defined delivery. In Ahadzie *et al*. (2007), the focus was on only speculative approach to housing delivery for future potential buyers/users. However, in recent times, from the practical perspective, this focus has been expanded to include user defined delivery along side the speculative motive. Here, by drawing on the practical attributes of MHPs, it could be well understood that, the particular type of houseunits could take several design forms such as terrace, multi-storey, semi-detached, detached or 'stand alone' residences and combination of them in scheme/s as intimated by Okehielem (2011) and Ahadzie *et al.* (2007). From the above definition it is worthy to note that, the designs and schemes may be speculative or specific customer defined. However, the underlining fact is that the designs remain standardized, repetitive, managed by defined team, under uniform contractual arrangement and mass-scale delivery of house-units. Another significant area missing in previous explanations is the number of units that must be produced under a package to merit the description of MHPs.

However, the number of housing units that merit the description of mass housing is difficult to define due to varying interpretations and perceptions among pratitioners. Practically, MHPs delivery is dominantly through schemes undertaken by multiple contract packaging of housing units under contractors or subcontractors in specified procurement charateristics. Ahadzie (2007) adopted a minimum delivery of 10 units to merit the MHP status by drawing on the perspective presented by Edmonds and Miles, (1984). Here in this study, it can be said that, the focus is towards managerial efficiencies and overcoming delivery challenges. However, Blismas (2001) intimated that multiple sites construction projects such as mass housing, are characterized by large numbers of similar sub-projects undertaken regionally, nationally or globally as part of a single medium to long-term project or programme and contracts and sub-contracts. This additionally offers unique managerial challenges, coordination and programming (Blismas, 2001). Hence drawing on the practical and theoretical perspective of multiple site projects and repetitive nature of mass housing projects, it can be taken that a minimum contractual packaging of 10 housing units is more likely to exhibit the needed managerial challenges unique to the MHP environment. Hence, this study will aim at a minimum delivery of 10-units per scheme/contract packaging to pass as a MHP.

It is thus very significant to not that, often the term housing has been used to denote a multi-dimensional commodity that encompasses the physical Shelter (buildings), the related services and infrastructure, and other inputs such as land and finance required to produce and its maintainance (EL-Rayes et al., 2000; Formoso et al., 2002; Pulat and Özsoy, 2008; Okehielem, 2011; Ghana Housing Policy, 2015). Hence in a study of this nature it is thus very significant for the focus to be delineated. In this study, the focus of the definition of housing is on the physical shelter component of hosing delivery.

2.3.1 Economic Significance of Housing Construction Industry and the Case for Mass Housing Delivery

In many developed and developing countries, the general construction industry makes significant contribution to the Gross Domestic Product (GDP) and plays a major role in their economic development (Giang and Pheng, 2011; Zawdie and Langford, 2000). In most sub-Saharan Africa countries, the industry accounts for about 5% of the GDP in relation to a corresponding average of 7% in developed countries (Zawdie and Langford, 2000). In capturing the broad contribution of the general construction industry to the GDP, it is primarily pertinent to learn that, the Housing Sector (HS) alone accounts for almost 60% of this contribution (Wells, 2007; Ofori, 2001; Zawdie and Langford, 2000). In Ghana, the housing sector is perceived to make a significant contribution to the GDP through the activities of informal private developers, real estate providers (e.g Ghana Real Estate Development Association-GREDA) and quasi government Institutions (BOG, 2007). Additionally, in many developing countries including Ghana, housing ownership, quality, affordability and access have been the major socio-economic indicators for measuring poverty, standard of living and the quality of its labour force (Balchin *et al.,* 2008; Robinson *et al.,* 2002).

In recent times, the provision of housing still remains one of the most critical socioeconomic challenges facing Ghana and other developing and developed economies (UNHABITAT, 2011; Owusu, 2009; BOG, 2007). This has called for renewed efforts through several government policies for the adoption of housing approach to overcome the challenges in delivery. Against this, mass housing delivery has gained global acceptance as a veritable approach to meeting the growing housing demands in many countries (Kolawole, 2012). Likewise, in Ghana, the government has shifted from its original position of being a facilitator and creation of an enabling environment for the private sector to actively deliver housing to an active developer. This has been through implementing mass housing schemes across the country directly funded by government and others in partnership with the private sector since the year 2000 (GEP, 2011).

However, inspite of the renewed benefits of the housing sector, the implementation of MHPs still experiences managerial inefficiencies and organisational ineffectiveness that are inherent in its nature and unique characteristics compared to traditional 'one-off' construction projects (Zairul and Rahinah, 2011; Khanzadi *et al.,* 2008; Enshassi, 1997).

2.3.2 Comparing the Attributes and Characteristics of Mass Housing to Traditional 'One-Off' Construction Projects

Project characteristics are the attributes of the project or the items which define the technical and managerial nature of the work (Cho *et al.,* 2009; Haslam *et al.,* 2005). Most studies on general project categorization and attribute models have combined both contextual and

general charateristics from the physical, orgnisational and operational perspectives to define the project features (see Manu *et al.*, 2010; Favié and Maas, 2008; Kipp *et al.*, 2008; Haslam *et al.*, 2005;). In the context of mass housing projects, the attributes such as the multiple site nature of project, repetitive design units, approach and method of construction, wide extensive geographical locations, project duration of repetitive units, procurement system, contract packaging, management concepts, concurrent engineering elements and subcontracting have been noted as the unique features of mass housing (see Ahadzie *et al.*, 2007 & 2014; Hwang *et al.*, 2013;
Ogunsanmi, 2012; Zairul and Rahinah, 2011; Favie and Maas, 2008; Mahdi, 2004; Oladapo, 2002; McKay *et al.*, 2002; Enshassi, 1997). These are perceived as the
organisational, operational, and physical attributes that characterise mass housing projects from managerial perspective.

For instance, Ahadzie *et al.* (2014) revealed that mass housing projects exhibit multiple sites location that defines its management intuition and approach making them unique compared to traditional 'one-off' construction building projects often encountered in the industry. Likewise Zairul and Rahinah (2011) acknowledged that mass housing projects are chracaterized by unique repetitive concurrent engineering elements often exhibited in its design and contract packaging that significantly affects communication among the project professionals across the project life-cycle. A study by Mahdi (2004) exploring the planning principles in mass housing project established repetitive design, tasks and planning as key attributes that are critical in MHPS organization and management concepts.

From an empirical assessment of the procurement characteristics of mass housing projects, Ogunsanmi (2012) and Oladapo (2002) reported that mass housing projects are charaterised by perculiar procurement sytems and project organization models compared to traditional building projects. Furthermore, Favie and Maas (2008) hinted that, outside the general attributes of most construction projects, housing developments based on mass production often exhibit multiple duration for completing tasks, units and the contract in the project life span / lifecycle. Likewise, Kipp *et al.* (2008) stated that the main chracteristics of mega projects such as road, ICT infrastructure and mass housing projects are in three distinct and perculiar areas which are varying time frame and duration, team and managerial cultural diversities and complexities in procurement and contract packaging. Accordingly, Ahadzie *et al.* (2014) and Zairul and Rahinah (2011) suggested that mass housing projects often occupy large geographical areas which may transcend to more than one geographical and administrative land boundaries of communities, suburbs, towns, cities and administrative regions. In the context of the organizational and operational perspective, Mahdi (2004), McKay *et al.* (2002), Yi *et al.* (2002) revealed that, MHPs exhibit repetitive design concepts and elements, adopts varied contractual and subcontracting arranegements that make them entirely unique from traditional projects.

Also, it is said that, MHPs exhibit mutilple design typologies in its contract packaging and thus makes traditional procurement arrangement and task management approaches highly unsuitable (Ogunsmi, 2012; Khanzadi *et al.,* 2008). Additionally, Kumaraswamy *et al.* (2009) and Yi *et al.* (2002) indicated that comparatively, MHPs exhibit multiple scheduling and planning attributes inherent from multiple interrelated tasks, elements and packaging making them highly succesptible to risk induced failures than traditional projects. Therefore, based on the extensive review of literature and a preliminary study, five main attributes were identified and conceptualized from the managerial perspective considering the physical, operational and organisational attributes. The summary of the unique features of MHPs have been summarized in Table 2.0.

2.3.3 Mass Housing Management Characteristics and Trends in Ghana

From a global perspective, the management concepts and approaches adopted on housing housing projects have mainly consisted of the traditional management style, contract and construction management and project management (Ahadzie, 2007; Hughes and Murdoch, 2001). These various management concepts have been applied to mass housing developments during different periods. In Ghana, the traditional management practices became dominant in mass housing project development from the late 1950s at a time when the Government of Ghana was solely in charge of housing supply thorugh its recognized agencies such as State Housing Corporation (SHC) and Tema Development Corporation TDC (Ahdzie, 2007; Ofori, 2001).

Under this management concept at that time, due to the absence of registerd contractors in Ghana, the delivery of housing units was by direct labour (trained masons, artisans and craftmen) under the supervision of a team of prefessionals with an architect as the team leader (Ahadzie and Amoa-Mensah, 2010; Ahadzie, 2007). From the late 1960s, recognized registered contractors were introduced into the country and this led to the engagement of multiple contractors on serial contracts managing the physical construction of the housing units with their own artisans and labour with team of professionals role being limited to the design phase and nomial supervion at the construction phase (Ahadzie and Amoa-Mensah, 2010; Ahadzie, 2007; Konadu-Agyemang, 2001).

From the late 1970s, housing delivery had diversified with the introduction of speculative housing delivery by private and quasi-government organizations such as the Social

Security and National Insurance Trust (SSNIT) (Ahadzie and Amoa-Mensah, 2010; Konadu-Agyeman, 2001). These private developers and quasi-organizations went into the appointment of professionals as external consultant to manage the design aspect of the project on their behalf due to the absence of these professionals in their organizations (Ahadzie, 2007). Under this era, there were formal contracts agreements between the contractors and the clients (private and quasi-organizations), also, management contarcting and construction management concepts were also employed alongside the traditional management system (Ahadzie and Amoa-Mensah, 2010; Ahadzie, 2007; Konadu-Agyeman, 2001).

However, there are several notions and perceptions of management challenges which contributed to poor performance of many housing projects and these management concepts (see Ahadzie and Amoa-Mensah, 2010; Ofori, 2001). Currently in the Ghanaian housing industry, the project management concept has also been accepted and practiced as a management approach to avert some of the management challeneges inherent in the traditional and contract management systems (Ahadzie and Amoa-Mensah, 2010).

Notwithstanding the popularity of the project management concept in the Ghanaian construction industry in recent times, there are adequate evidence that suggest that, the traditional management concept is still embedded as the dominant management practice in the housing sector and the industry as a whole (Ahadzie and Amoa-Mensa, 2010; Ahadzie, 2007).

2.4 UNIQUE FEATURES OF MASS HOUSING PROJECTS

Construction projects possess unique attributes which are defined by the physical, organizational and operational features (Manu *et al.*, 2010; Haslam *et al.*, 2005). The physical attributes of the project define the technical inclination of the work (Cho *et al.*, 2009). Construction projects generally possess critical physical features that define the management style, types of relationship among the project team, procurement options and the communication type and strategies to be adopted (Favie and Maas, 2008; Sandhu *et al.*, 2008; Blismas, 2001). Blismas (2001) stressed that, managing projects which exhibit geographically dispersed network as well as some degree of repetitive task activities encounter a unique situation which exacerbates the complexity of project programmes. These attributes are perceived to further presents managerial and communication challenges especially among disperesed and virtual project teams (Gameson and Sher, 2005; Levitt, 2007). Monge *et al.*, (1998) revealed that there is a positive relationship between proximity and interaction among the project participants and that collocated teams are more likely to forge alliance than virtual teams. That is interactions among physically close project participants are effective and faster than dispersed and virtual teams (Monge *et al.*, 1998; Kajewski *et al.*, 2003; Gameson and Sher, 2005).

Conceptually, mass housing projects are perceived to exhibit unique physical, organizational and operational attributes, which are defined by the design typologies, procurement, project environment, contractual arrangement, construction, site organisation and management intuition (Ahadzie *et al.*, 2014; Zairul and Rahinah, 2011; Khalid, 2005; Mahdi, 2004; Yi *et al.*, 2002;). Practically, Mass Housing projects (MHPs) possess unique physical features which present inherent procurement and communication requirements among the project team in its management (Ibem *et al.*, 2011; Zauril and Rahinah, 2011; Khanzadi *et al.*, 2008). There exists increased managerial and communication linkages among the project team in MHPs than in traditional one-off building project (Hwang *et al.*, 2013; Zauril and Rahinah, 2011). Significantly, as the number of project teams and project sites increase, there is an increase in the communication challenges and managerial complexities among the team (Sandhu *et al.*, 2008; Blismas, 2001). The physical features of MHPs are depicted by multiple sites for various units, multiple standardized design-units in scheme and multiple geographical locations for schemes (Ahadzie *et al.*, 2014; Zairul and Rahinah, 2011; Khalid, 2005; Blismas, 2001). Sandhu *et al.* (2008) and Blismas (2001) posisted that, the physical characteristics of projects influence the degree of complexities, the challenges in its management and the project success.

Managing the organisational perspectives of any construction project is people and/or team oriented. The construction process is said to be collaborative in nature (Watson and Gallagher, 2005; Drinkwater, 2007; Anumba and Evboumwam, 1999). Against this, the knowledge of the communication challenges and requirement of the organisational tasks is critical towards team effectiveness, collaborative task efficiency and performance (Anumba and Evboumwam, 1999). Further to this, Rho (2009) stated that, the organisational attributes of projects in management set ups significantly influence the communication performance and organisational effectiveness. This also affects the organisational task fucntions on the the project in the context of the communication channel and the flow of information within or among workgroups and teams in organizations.

To this end, the organisational features of MHPs are depicted by its complex network of team relationship, multiple interdependent sub-contracting under scheme and complex network of procurement systems (Ogunsami, 2012; Oladapo, 2002; Adinyira *et al.*, 2013). These attributes of MHPs pose unique communication performance implications among the project team in its management (Ahadzie *et al.*, 2014; Enshassi *et al.*, 2009; Enhassi, 1997).

To this, it can be contended that the effective performance of the organisational tasks in any project environment by overcoming the inherent organisational challenges and the implications to its management approach is crucial. Hoezen *et al.* (2008) emphasised that the efficiency and effectiveness of the construction process strongly depend on the quality of communication and thus the critical factors affecting the communication among the project team are related to the organisation of the construction process. As projects get more organisationally complex, achieving and maintaining effective communication among the key players becomes more problematic (Dainty *et al.*, 2006; Hoezen *et al.*, 2008; Hyvari, 2006).

In the view of Mead (1999) and Chou and Yang (2012), the successful performance of the operational tasks and procedures in a project environment and construction process strongly depends on successfully sharing required project related information. Likewise, the ability to enhance project team effectiveness and project management efficiency is dependent on giving increased attention to the behavioural, operational and organisational factors of project management and the project (Hyväri, 2006). It is said that the operational tasks of construction projects remain one of the critical domains of managerial effectiveness (Hyväri, 2006).Mass Housing projects (MHPs) exudes unique operational features that make their management requiring unique behavioural skills compared to traditional projects (Khanzadi *et al.*, 2008; Yi *et al.*, 2002). Additionally, the operational task functions that characterize the management of MHPs define its unique operational features. These are defined by duration schedules and planning on housing units, organization of preliminary activities and contract packaging and management concept for labour contracting and subcontracting (Hwang *et al.*, 2013; Khanzadi *et al.*, 2008; Yi *et al.*, 2002). Mass Housing project environment involves interdependent, collaborative and multi-disciplinary team participants and thus project participants who communicate by adapting to the project's characteristics and operational context are more likely to be successful and promote team effectiveness.

Traditionally, duration of construction projects, tasks and sub-projects remain an important tool for devising strategies and management concepts suitable for the project (Martin *et al.*, 2006; Mahdi, 2004). Construction projects are normally delivered by setting duration for the tasks, activities and the overall project through precise schedule estimation and planning. According to Manu *et al.* (2010), often on construction projects, the targeted construction duration estimated may have variation with the actual duration by either time over-runs or early completion. Similarly, Sandhu *et al.* (2008) revealed that project complexities and characteristics hugely influence the duration estimation approach.

In contrast, situations where a constrained and unrealistic duration is set to a task, activities or the overall project, there is seemingly induced time pressures that may significantly influence the communication performance and safety management (Gluch and Raisanen, 2009; Brace *et al.*, 2009; Wong *et al.*, 2004). Also, when the adopted duration estimation does not suit the project characteristics, the consequence to management and communication performance among the team could be enormous. Hwang *et al.* (2013) revealed that communication remains a central factor affecting schedule performance of public housing projects. Practically, in mass housing delivery, there is the interplay of several repetitive housing units, tasks and activities requiring different estimation approaches to adapt to these unique particularities in order to ensure effective management and delivery success.

Attaining managerial effectiveness in project management practice has in recent times gained credence due to its inherent benefits towards project success and increased productivity (Ling and Ma, 2014; Hwang *et al.*, 2013; Enshassi, 1997). Additionally, Dainty *et al.* (2006) and Dawood *et al.* (2002) espoused that, communication management, performance and strategies in any project environment is influenced by factors that are related to the operation, organization and management tasks of the construction process. Favié and Maas (2008) also contended that, the attributes of projects are major parameters and inputs for the right choice of procurement method, risk analysis, communication strategy and technology as well as dictating the resource requirements for its delivery. To this effect, a clear understanding of the unique attributes of MHPs and their implications for communication performance is crucial to appropriately develop and adapt strategies towards effective communication. Building on previous studies, this study through a critique from the managerial perspective (physical, organizational and operational attributes) of project characteristics literature interrogates and provides insight into the unique attributes of MHPs. Following this, five main broad themes of the unique features of MHPs were identified and summarized in Table 2.1. The following section presents exposition on the five broad themes identified in Table 2.1.

TABLE 2.1: DERIVING THE UNIQUE MASS HOUSING PROJECT FEATURES

S/No.	PROJECT FEATURES AND ATTRIBUTES OF MASS HOUSING	AUTHORS										
		Behm, (2005)	Favie and Maas (2008) (2008)	Kipp et al.	Mahdi (2004)	Hwang et al. 2013	Yi et al. (2002)	McKay et al. (2002)	Khanzadi et al. (2008)	Zairul and Rahinah (2011)	Ahadzie et al. (2014)	Ogunsanmi (2012)
1	Multiple Construction Sites Management Style Features	√			√	√	√			√	√	√
2	Housing Unit Design Contract Packaging Features	√			√		√	√	√	√		
3	Multiple Geographical Locations for Various Schemes Features		√	√		√		√			√	
4	Complex Network of Procurement Systems Features	√		√	√	√						√
5	Repetitive Tasks Management Delivery Strategy on Housing Units Features		√		√	√	√		√	√	√	√

Source: Authors compilation from Literature

2.4.1 Multiple Construction Sites Management Style (MCS)

The multiple construction sites management features of mass housing projects are usually determined by the physical and organizational attributes that define their technical, design and management nature. In the view of Ahadzie *et al.* (2014) and Blismas (2001), mass housing projects often exhibit multiple sites for various units as a unique characteristic feature and that several factors define this feature. The term multiple sites is where individual housing units are located on individual sites but may be packaged under one scheme, managed by the project team and under series of various contractors and/or subcontractors. The site management style, construction methods and technology adopted, contractor management concept, computer application, health and safety management concept, site location for packaged units accounts for the uniqueness of the multiple site features of mass housing projects (Syed *et al.,* 2010; Khalid, 2005; Blismas, 2001; Enshassi, 1997).

Additionally, the multiple site nature of MHPs is further elaborated by the reporting and programming techniques and documentation style adopted (Blismas, 2001; Zairul and Rahinah, 2011; Mahdi, 2004; Hwang *et al.,* 2013). It is affirmed that, the defining factors of the multiple site nature of mass housing projects have influence on the management intuitions especially on repetitive tasks (Blismas, 2001; Mahdi, 2004; Yi *et al.,* 2002; Zairul and Rahinah, 2011).

2.4.2 Housing Unit Design Contract Packaging (HDP)

This attribute of mass housing explores the design concept, construction elements, and contract packaging in the mass housing scheme. Mass housing projects often adopt repetitive designs units that may be single or several in the contract packaging across all contractors and/or subcontractors under the scheme. There are wide ranges of housing design types that may be adopted for use in mass housing development either by speculative delivery or user defined depending on their suitability (Hsu and Shih, 2006; French, 2006). Hence, in typical mass housing developments, various design typologies are often developed into contract packages. As noted by Saji (2012) and El-Rayes (2000) housing design types often used in mass housing range from Terraced house, Semidetached, Town houses, detached houses, Courtyard houses, Mansion block, Decked Access Block, Tower Blocks, Split-level depending on the needs of the market and thus offer managerial and packing connotations. However, from a practical perspective, the design concept of housing units is expanding to include high rise condominiums made up of varing units in one single structure. This is becoming very popular in Asia, the Arab world and parts of Africa including Ghana.

Contract packaging and organization of related aspects of construction contracts remain an approach to ensuring managerial efficiencies and project success (Ong, 2007). In mass housing projects, organization of preliminary items tends to take different approach compared to traditional building brojects. It is quite clear that the term “preliminaries” has been used extensively with construction contracts, but there seems to be lack of consensus on the definition of the term. In today’s global construction industry, “preliminaries” have remained a significant component in conventional contracts for delivering construction projects. According to Ong (2007), “preliminaries” are defined by bundle of resources of diverse attributes and characteristics in the Bill of Quantities (BOQ) of construction contracts. Likewise, Ong (2007) indicated that, sometimes “preliminaries” may cover items that are not readily attributable to specific items and tasks but may be site and project specific and thus several approaches may be most suitable in its packaging. On mass housing projects where contract packages generally involve multiple repetitive housing units managed by various contractors or labour managed approach, packaging of these items significantly take varying forms which have implcations in its documentation, management and decisions.

2.4.3 Multiple Geographical Locations for Various Schemes (MGL)

Sometimes, multiple geographical locations of mass housing projects become the major unique characteristic feature that adds to the management complexities. This feature of mass housing refers to a situation where a single site for mass housing projects extends into more than one local government administration. In Ghana, local government administrative areas share unique local bye-laws, cultural influence, tenural land customs and ownership traditions (Ahadzie *et al.*, 2014; Owusu, 2009). It is noted by Blismas (2001) that, organisations encounter a unique situation when programmes are instituted to develop construction projects by a geographically dispersed network. In the light of this, the geographical disparity of sites exacerbates the complexity of such programmes in their management (Blismas, 2001).

2.4.4 Complex Network of Procurement Systems (NPS)

Procurement systems on construction projects are considered very crucial in the successful delivery of the project (Gray and Hughes, 2012; Jefferies *et al.*, 2002). According to Hoezen *et al.* (2010), procurement method and style adopted on construction projects specify the contractual arrangements and the responsibilities within single or multiple project teams that may enhance or impede communication. It is also postulated that procurement arrangements are more likely to promote team integration that significantly enhances collaboration among the team towards effective management (Walker, 2007; Kumaraswamy *et al.*, 2005). Mass housing projects adopt varied procurement approaches in the selection of contractors, procurement of materials and consulting teams.

From a practical perspective, mass housing consulting teams may take the form of interplay of either a team wholy from outside the developing organization, wholy from the organization and a mix of part from the organization and part from outside the organization. Additionally, several subcontractors may be engaged on various contract packaging under the scheme being managed. Another area deemed very crucial in procurement arrangements and contractural definitions on construction projects is contractual relationship defined by the adopted procurement system (Hughes and Murdoch, 2001). Construction projects in general involve the interplay of several participants who form complex contractual relations and interdependent networks among the participants (Hoezen *et al.*, 2008; Otter, 2005; Gameson and Sher, 2005). These networks of relationships exhibit unique social and technical influence on the tasks and activities as well as the management concept.

Chatman and Flynn (2001) intimated that, project teams often exhibit diversity, complex and relational networks that significantly impact on team functioning along such dimensions as cooperation, creativity, cohesiveness, decision making and communication effectiveness. Otter (2005) further indicated that construction project teams adopt organisational set-up that makes use of formal and informal communication lines and networks that significantly influence the information flow and composition. Mass housing project development in Ghana and many developing countries have shifted focus from purely speculative approach to embrace situations where design units are built to client identified taste and preference. This denotes that the clients are part of the construction process in view to incorporate their requirements and meet their needs. These developments tend to extend the contractual and communication network on the project. Additionally, the project team form varied communication, task relationship and protocols that sometimes are unique due to the traits of the project being managed. Here the attributes of MHPs lies in the communication relationships, reporting styles and protocols among the project team.

Subcontracting has remained a procurement characteristic of mass housing delivery (Ogunsanmi, 2012). Sub-contracting arrangements are often integrated into construction projects and are significantly useful for organizational analysis that enables the management task to be deconstructed into its elemental parts (Walker, 2007; Hughes and Murdoch, 2001). This allows for the order that enables effective organizational structures to be developed and adapted to suit the project environment (Hughes and Murdoch, 2001). The contracting arrangements on mass housing projects define the contractual packaging, sub-contracting arrangement and labour management styles adopted (Ogunsanmi, 2012; Oladapo, 2002). Mass housing developments adopts various subcontracting approaches that extend across various elements such as labour and trades. It is considered as very useful and brings clarity to the description of roles and responsibilities in construction projects and thus helps in assembling a team and specifies roles for project participants (Hughes and Murdoch, 2001).

2.4.5. Repetitive Tasks Management Delivery Strategy on Housing Units (RDS) Studies have pointed to the influence of repetitive nature of mass housing projects and delivery strategy on the planning and scheduling complexities (Hwang *et al.*, 2013;

Khanzadi *et al.*, 2008; Mahdi, 2004). This is often related to the extent of the contextual approach to the management, control, monitoring and communication on the tasks related to these repetitive attributes (Mahdi, 2004; Yi *et al.*, 2002). Emerging complexities and sophistications associated with nature of construction projects demand a commensurate exponential expansion of human knowledge, skills and techniques to adequately deliver them in morden project management practice (Bakouros and Kelessidis, 2000). Construction projects require an integration of both manual and mechanized processes handled by professionals, artisans, tradesmen etc.

According to Suraji *et al.* (2001), construction tasks delivery will always require a detailed and adequate understanding and right application of skills and communicated information. This allows tasks performers to adequately plan, deliver, supervise and control in order to succeed (Suraj *et al.*, 2001). Suraji *et al.* (2001) further asserted that tasks on construction projects are interrelated sequencially which have implications for health and safety, risk and management intuitions. Typically, mass housing projects involve extensive repetitive interrelated tasks requiring skills across several housing units under scheme being managed (Ahadzie *et al.*, 2014; Mahdi, 2004; Yi *et al.*, 2002). This attribute comparatively often demand unique technique adopted in the performance of the interrelated tasks and sequence of task actions such as planning, programming, scheduling etc (Hwang *et al.*, 2013; Mahdi, 2004).

Against the background of these attributes of mass housing projects, in the present study, these features have been hypothesised as latent factors (variables) for the development of mass housing project team communication effectiveness model that evaluates the contribution of the features to team communication performance. The various indicator variables under these latent factors (variables) for the development of a holistic evaluative communication effectiveness model have been summarized in Table 4.0 in Chapter 4.

2.5 SUMMARY

This chapter presented a review on mass housing and its inherent atributes compared to 'one-off' traditional projects. It also revealed an adopted definition of mass housing in the context of the study. From the review, it indicated that, MHPs share physical, operational and organisational features and its critical implication for communication performance among the project team is yet to be explored. Subsequently, the chapter concluded by establishing that the Mass Housing construction process is unique and highly dependent on communication for ensuring team effectiveness and and project performance. In the next chapter communication models and performance measures are presented.

CHAPTER THREE

CHAPTER THREE 3.0 CRITICAL REVIEW OF COMMUNICATION AND PROJECT TEAM COMMUNICATION PERFORMANCE

3.1 CHAPTER OUTLINE

In this chapter, there is a presentation of the contextual meaning of communication as related to the construction industry. To be able to clearly understand communication as well as relating it to the research problem and questions, the concepts, the theories of communication and communication performance measures in the construction industry is also elucidated. The chapter concludes with an exposition on the knowledge gaps identified in the area being researched.

3.2 CONCEPTS AND DEFINITION OF COMMUNICATION AND PROJECT TEAM COMMUNICATION

The concept of communication has been studied in business, sociology, anthropology, psychology, and most recently in the field of organisational communication and this gives it a diverse background which is often though extensive but quite fragmented (Dainty *et al.*, 2006; Salleh, 2008; Adler *et al.*, 2004; Morreale *et al.*, 2006; Spitzberg and Chagnon, 2009). Communication remains a complex activity to define due to its broad application and practice in several domains (Hoezen *et al.*, 2008; Dainty *et al.*, 2006; Adler *et al.*, 2004). It is perceived as an essential process which has a bearing on every human endeavour and remains a critical activity to any organisation's survival (Kester *et al.*, 2008). Communication is critical towards attaining organisational goals, project success and improvement in relationship (Kester *et al.*, 2008; Salleh, 2008; Cegielski *et al.*, 2008;

Dainty *et al.,* 2006).

In Business environment, the term communication is often related to information and is thus defined as flow and transfer of information from one person to another (Keyton *et al.*, 2013; Keyton, 2011; Spitzberg and Chagnon, 2009; Kester *et al.*, 2008). In Organisational context, it is perceived as planning, controlling and managing information in an establishment (Poole, 2005; Adler *et al.*, 2004). The term has also been described as transmission of a message through a medium from sender to receiver to attain understanding (Adler *et al.*, 2004). The construction industry perceives communication beyond the element of just transfer of information and adopts both linear and organic forms among the project participants (Zid, 2011; Emmitt and Gorse, 2007; Dainty *et al.*, 2006; Gorse and Emmitt, 2003). Construction Project Communication (CPC) entails the processes required to ensure timely and appropriate generation, collection, distribution, storage, retrieval, and ultimate disposition of project information to aid mutual understanding among the project participants (Zid, 2011; PMI, 2008; Gorse and Emmitt, 2007; Dainty *et al.,* 2006).

Additionally, in the context of the construction industry, communication is emphasised as the transfer, flow, conveying, sharing of goals, ideas, knowledge and information necessary for all project team players towards the success of the project (Liu, 2009; Whited *et al.*, 2007; Danity *et al.*, 2006; Gorse, 2006). From the above, it could be deduced that the perception of communication in the construction industry differs from other disciplines and industry and could even be segregated to reflect its functions at the various construction project phases. It should however be emphasized that in the context of this study, communication is perceived as project team communication. Infering from Anumba and Evbuomwam (1999), project team communication entails transmission of project related information among all the participants of the project team such as the architect, project manager, quantity surveyor, client, contractor, sub-contractor and engineers.

Project team communication is also defined as sharing of project information through adopted communication style suitable to the project's characteristics and organizational context that promote good relationships towards success (Müller, 2003). Typical project information likely to be communicated may include drawings, contract documents, payments data, policy and manuals, specifications etc that must be interpreted with a common and mutual understanding (Otter, 2005; Shen, 1992). Given the nature of Mass Housing Projects (MHPs), it is critical to adopt or evolve a definition that reflects the nature of the project environment. Infering from the definition above and nature of MHPs, as well as the practical and theoretical perspective of MHP environment, project team communication shall be defined as:

The generation, transmission, sharing, distribution and exchange of project related information, knowledge, ideas etc among the project team members by adapting media to aid mutual understanding, control and coordination at the right time necessary to accomplish the project goal and success in the delivery of the project.

The influence of the MHPs environment in the definition above is seen in the adoption of medium and strategies that considers the attributes of mass housing rather than generic media. The nature of MHPs draws on team that is multidisciplinary, with different interpretations, meaning and understanding of project related information to different professions. In this regard, it is important that the definition attains and reflects a situation of common understanding, procedure, and timeliness of the project information communicated among the team to coordinate the construction process successfully to attain project goals.

3.3 COMMUNICATION IN THE CONSTRUCTION INDUSTRY

Effective collaboration and coordination among the project team is critical and its success greatly depends on effective communication performance among the team on the construction project (Zid, 2011; Yang *et al.,* 2007; Dainty *et al.,* 2006). Communication is regarded as critical among the key factors influencing the successful delivery of construction projects (Dainty *et al.*, 2006; Otter, 2005; Emmit and Gorse 2003). Inspite of all these assertions and studies on the subject relating to the construction industry, ineffective communication remains a predominant problem in the industry (Liu, 2009; Hoezen *et al.,* 2008; Danity *et al.,* 2006; Emmit and Gorse, 2003; Xie, 2002). And it is against this background that, it is recommended that communication in the construction industry be improved (Liu, 2009; Dainty *et al.*, 2006; Thomas *et al.*, 1998; Hunter, 1993).

Communication in the industry has taken the form of orders, directives, information, documents, requests to and from participants through several means and channels assisted by several techniques and tools (Gorse and Emmitt, 2007; Otter, 2005). Studies on communication in the construction industry has seen remarkable progress from the 1960s evolving from its importance to the sector, exploring the role of Information Technology to communication in the construction industry, impact of communication to project performance and improving communication effectiveness and performance among the project team (*see* Otter and Emmitt, 2007; Dainty *et al.,* 2006; Gorse, 2006; Emmit and Gorse, 2003; Dawood *et al.*, 2002; Mead, 1999; Thomas *et al* 1998).

Although several studies from the late 1990s to date have focused on communication in the construction industry and affirm its importance to the sector in project delivery, there are still suggestions for more improvement (Liu, 2009; Dainty *et al.*, 2006; Xie, 2002; Mead, 1999). It has been elucidated that, the construction process has become highly collaborative in terms of team and task based processes involving specialised professions or organisations composing the project team coupled with complex and varied attributes of emerging projects (Liu, 2009; Baiden *et al.*, 2006; Xie, 2002; Mead, 1999). In the light of this, other studies by Hoezen *et al.* (2008) Dainty *et al.* (2006) and Thomas *et al. (*1998) contended that, a critical area for communication improvement in the construction industry is within the project teams and among project participants towards reducing project failures.

Effective communication, including the integration of specialised knowledge and negotiation of differences between team members, is a vital process for collaborative design projects (Dainty *et al.*, 2006). To this end, several studies in recent times have concentrated and advocated for project team effectiveness to enhance delivery (Azmy, 2012; Liu, 2009; Danity *et al.*, 2006; Xie, 2002). It has been highly recognized that the key critical factor for enhancing team integration, managerial efficiency, effective cordination and collaboration has been communication among the project team (Azmy,
2012; Ochieng and Price, 2010; Gorse and Emmitt, 2007; Gorse, 2006; Thomas *et al.*, 1998). Perhaps this is a justification for recent surge in expansive research in communication effectiveness and communication performance among the project team in the construction industry (see Xie *et al.*, 2010; Liu, 2009; Dainty *et al.*, 2006; Xie, 2002; Dawood *et al.*, 2002; Murray, 2000, Murray *et al.*, 2000; Mead, 1999).

Inspite of this, emerging studies have found communication problems among project teams as very prevalent and that communication among the task group (project team) is the third significant factor that needs serious focus and attention (Liu, 2009; Hoezen *et al.*, 2008; Otter, 2005; Xie *et al.*, 2000). It is contended that improving communication effectiveness among the project team is not an absolute achievement but rather a continuous process through evaluation and improvement to enhance efficiency of the methods and tools used (Liu, 2009; Emmitt and Gorse, 2003). It is further emphasised that factors affecting project team communication performance may likely differ from project to project or location to another and that adopting a single theory and measure among the team across all project typologies is likely to be ineffective (Gorse and Emmitt, 2003; Xie, 2002; Zid, 2001).

Mass housing projects (MHPs) continue to experience managerial inefficiencies and communication ineffectiveness that are inherent in its unique attributes and project environment (Ahadzie *et al.*, 2014; Ibem *et al.*, 2011; Enshassi *et al.*, 2009; Enshassi, 1997). Subsequently, inefficient communication inherent in the unique nature of mass housing among project teams have resulted in considerable amount of unproductive time on mass housing projects (Enshassi *et al.*, 2009; Enshassi, 1997). This however has yet to be subjected to any empirical investigation. Improving project team communication effectiveness is underpinned by the widely held assumption that project success is strongly related to the effectiveness of communication on the project (Crawford *et al.*, 2002; Dainty *et al.*, 2006; Ingason and Jónasson, 2009). It can be adduced that improved communication management and performance by concentrating on the project team in the construction industry will result in reducing failures (Gorse, 2006; Dainty *et al.*, 2006; Otter, 2005).

3.4 COMMUNICATION TYPES AND COMMUNICATION THEORIES IN AN ORGANISATION

It can be said that communication is context dependent (Salleh, 2008). For this reason, it makes its broad, unilateral and generic application and form very difficult in all organizational or project setting (Ochieng and Price, 2010; Danity *et al.*, 2006; Hogard and Ellis, 2006; Eckert and Clarkson, 2004; Ellis, 2002). This is because organisational and project setting tends to be unique and thus require varying forms of communication in these different contexts (Salleh, 2008; Dainty *et al.*, 2006; Hyväri, 2006). In literature, communication has been classified based on the nature of communicators involved as well as the communication context (Gunhan *et al.*, 2012; Hassall, 2009; Salleh, 2008; Cegielski *et al.*, 2008; Hyväri, 2006; Hogard and Ellis, 2006; Otter, 2005). In a typical setting, communication can take the form of inter-personal, inter-departmental, interorganisational, verbal and non-verbal as well as synchronous and asynchronous communication (Keyton, 2011; Otter and Emmit, 2007; Otter, 2005; Hornik *et al.*, 2003).

These concepts of forms of communication have been explained in the ensuing sections.

3.4.1 Communication Types

In a typical organizational and project environment, Otter and Emmit (2007) provide an insight into the forms of communication as being synchronous and asynchronous forms. Synchronous communication takes the form of face-to-face means like meetings and dialogues that happen at the same place whiles asynchronous communication takes the form of using postal mail, paper delivery services, and using electronic means to communicate at different times and mostly at different place (Otter and Emmitt, 2007).

Communication is also classified in the human context and nature of communicators as intrapersonal, interpersonal, inter-departmental, inter-organizational, group communication, mass communication and multi group communication (Keyton, 2011; Keyton and Shockley-Zalabak, 2006; Adler *et al.*, 2004; Emmit and Goorse, 2003). Inter personal communication involves the sharing of information among individuals and is very critical towards maintaining relationship among the individuals (Kester *et al.*, 2008; Adler *et al.,* 2004; Emmit and Goorse, 2003). Intrapersonal communications on the other hand enables an individual to process information to aid mutual and coordinated understanding (Liu, 2009; Otter and Emmitt, 2007; Emmitt and Gorse, 2003). Groups and Multi-group communication entails the sharing of related information among and between workgroups to enable them coordinate efforts, tasks and activities in the organizational and project environment (Morreale et al., 2006; Adler *et al.,* 2004; Müller, 2003). In the context of project communication, both external and internal forms are encountered (PMI, 2008; Otter and Emmitt, 2008; Murray, 2000). Internal communication involves related information limited to only project participants whereas external communication includes sharing information with people (stakeholders) who may not directly be involved in the project process (PMI, 2008; Gorse, 2006; Otter, 2005).

In a typical project environment, many forms of communication are critical towards the timely sharing of the project related information for decision making as well as taking actions for successful delivery. According to Azmy (2012), Yang *et al*. (2007) Dainty *et al*. (2006) and Otter (2005), project team communication entails sharing of project related information among the members and participants on the project excluding persons not in the team. Anumba and Evbuomwam (1999) also suggested that, project communication relates to use and transfer of project information among the Architect, Project manager, Quantity Surveyor, Engineers, Main contractors, Sub-contractors and the Client(s). This is because these members are actively involved in the day to day management of the construction process for which other stakeholders do not partake. To this end, based on the practical and theoretical persective of the mass housing construction industry in Ghana and other developing countries, project team communication shall be limited to the sharing of project related information among and between members of the project team at the construction stage.

3.4.2 Communication Theories

The universal law of communication theory says that all living beings whether they are plants, animals, human beings communicate through sound, speech, visible changes, body movements, gestures in the best possible way to make others aware and understand their thoughts, feelings, problems, happiness or any other information (Jablin and Sias, 2001; Goulden, 1992). Jablin and Sias (2001) emphasized that, large number of people support the model of communication that is perceived simply as the process of transferring information from the sender to the recipient where the recipient decodes the information and acts accordingly.

The positional theory posits that, organisational and team communication can also be analysed more specifically in terms of positional, relational, and cultural roles performed (Jablin and Sias, 2001; Monge, 1987). The positional theory is the classical view of structural communication theory and concluded that communication structure can be understood as a pattern of formal relations among positions within an organisation or group

(Jablin and Sias, 2001; Monge, 1987). From this persepective, the sharing of information is determined by the organizational chart within groups. However, the inadequacies of the positional theory reside in its inability to assess how individuals shape communication within diverse organisations and in informal environment (Jablin and Sias, 2001).

The inadequacies of the positional theory led to the development of the relational theory which looks at individual behavior in developing and maintaining communication linkages within organizations. The relational theory contends that a communication can be analysed by observing the interactions of people within a group. In contrast to the positional tradition, which sees network structure as formal and static, the relational theory on the other hand assumes that individuals often communicate in informal ways that are beyond their positions. The major criticism against the relational theory is that it fails to accurately offer reasons for and attributions of the communication performance in any context (Salleh, 2008). Against this, Salleh (2008), Weiner (2006) and Jablin and Sias (2001), the Attribution Theory offers an accurate explanations for the communication performance outcome in any context. Thus, Weiner (2006) affirmed that, external and internal factors are the main causal factors for the communication performance outcome in any context.

Theoretically, in the construction industry, communication is perceived to lie in the behavioural domain that encompasses interpersonal and organizational communication (Henderson, 2008; Salleh, 2008). Hence communication task performers fittingly maintain their ability to accomplish their own interpersonal goals in a given context ensuring mutual understanding (Henderson, 2008 & 2004; Salleh, 2008). In a typical construction project environment, the construction process is heavily dependent on required information that should be communicated to all members of the project team. It could be said that the construction process involves the interaction and sharing of project information to a multi-disciplinary teams requiring technical, scientific knowledge, skills and behaviours to perform the communication (Reeta and Neerja, 2012; Gorse and Emmitt, 2007). It is suggested that the communication required in a construction environment differ significantly from business and organisational settings (Dainty *et al.*, 2006). Hence in order to fully understand and appreciate the communication process, and communication performance among the project team, the key elements of the communication process and communication performance must be clearly defined and understood.

3.5 THE CRITICAL COMPONENTS IN THE COMMUNICATION PROCESS

A typical communication action will involve senders, receivers and a medium or channel for sending the information (Keyton, 2011; Gunhan *et al.*, 2012; Emmitt and Gorse 2007; Otter and Emmitt, 2007; Dainty *et al.,* 2006; Otter, 2005). To this end, to effectively understand and make any significant strides towards improving the communication effectiveness, attention must be given to the above components of the communication process.

3.5.1 Communication Process Model

There are several basic models used in communication research to describe the communication process and these have been drawn from psychology and sociology by different researchers. The Shannon and Weaver (1949), Schermerhon et al, (1994) and Te'eni, (2001) models have remained relevant to the construction communication context (see Dainty *et al.,* 2006; Xie, 2002; Murray *et al.,* 2000; Dawood, 2000; Thomas *et al.,*

1998).
The Shannon and Weaver (1949) model defined a mathematical theory of communication and postulated a linear process between the sender (source of information) and the receiver of the information as depicted in Figure 3.1.

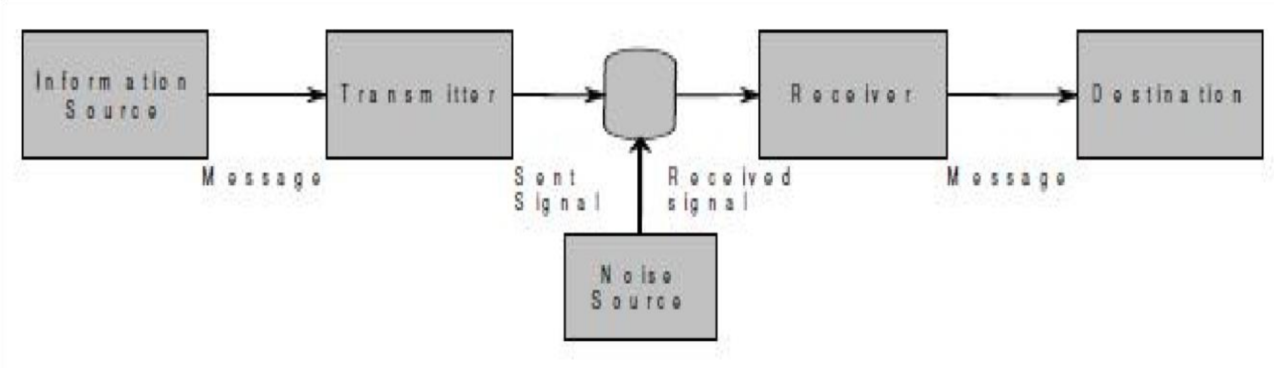

Figure 3.1: Shannon and Weaver Communication model (1949)

The model identified three main components of the communication process as the *sender*, *receiver* and the *channel or medium*. In the Shannon and Weaver (1949) model, messages are transmitted into signals from the sender and the receiver transmits the signal back into message for his use. The obvious set back of the model is that the receiver does not give a feedback. In a typical construction environment, information is sent for the mutual benefit of all the participants and the only surety to the right use of information sent or distributed is through feedbacks received.

Against this background, it could be said that, communication is a two-way affair and that feedbacks are expected to complete the process in a construction project environment. Hence, the lack of feedback in the Shannon and Weaver (1949) model led to the modification giving rise to the Schermerhorn *et al*. (1994) model. This model places premium on the sender and the receiver's ability to encode and decode message in ensuring communication effectiveness. In this model, there is an introduction of a feedback loop from the receiver to the sender as indicated in Figure 3.2.

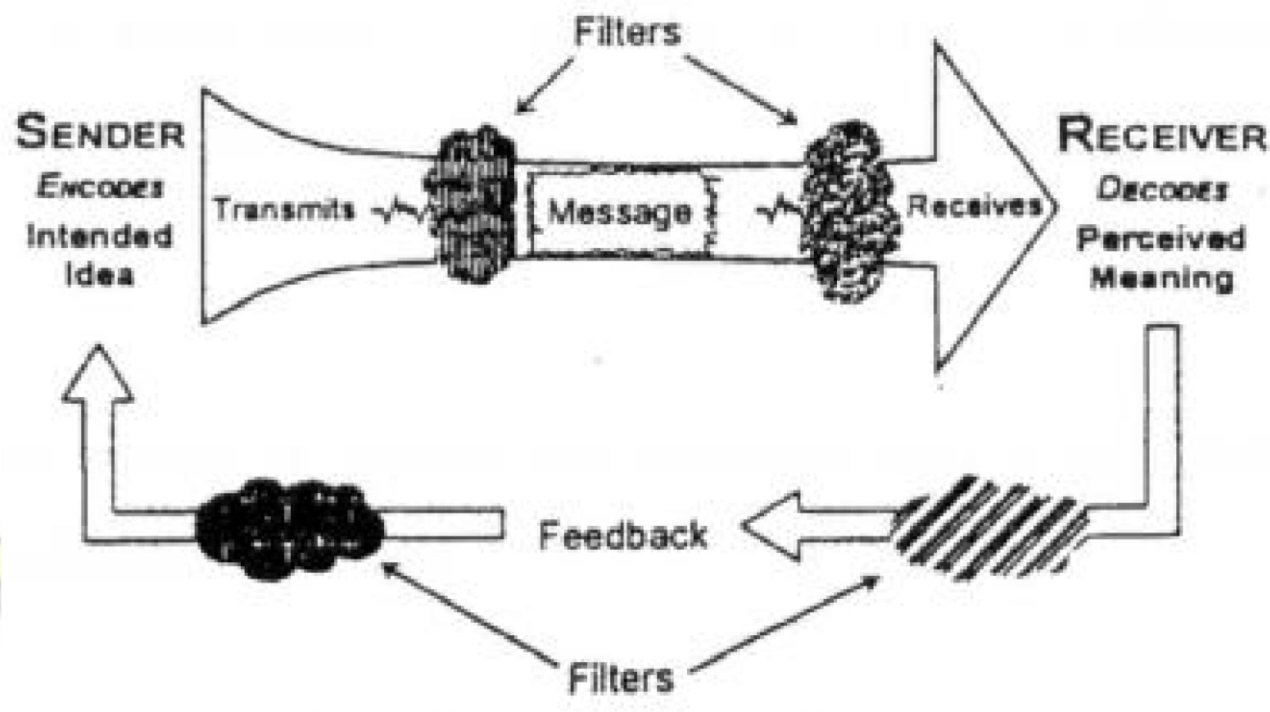

Figure 3.2: Shermerhorn et al. (1994) model of Communication.

From the Shermerhorn *et al.* (1994) model of Communication, Thomas *et al*. (1998), and Robar (1998) suggested that the critical and central attributes of the sender and receiver to ensure communication effectiveness and performance will greatly depend on their skills, knowledge and behaviours in the context within which the communication is required and performed.

The construction industry and the construction process form a complex communication environment and these complexities increase exponentially during the construction stage

(Hoezen *et al.*, 2008; Xie, 2002). However, this model also fails to account for such complexities. Considering the issue of complexities in earlier communication models, the Te'eni, (2001) communication model identifies three major complexities in the communication process and contends that, in any communication setting or context, the attributes of the communication inputs (sender), communication impact (receiver), the communication process (goal, medium and strategies) and the communication context (project environment) must be able to resolve and overcome the threats of the complexities to achieve communication effectiveness in the context as presented in Figure 3.3.

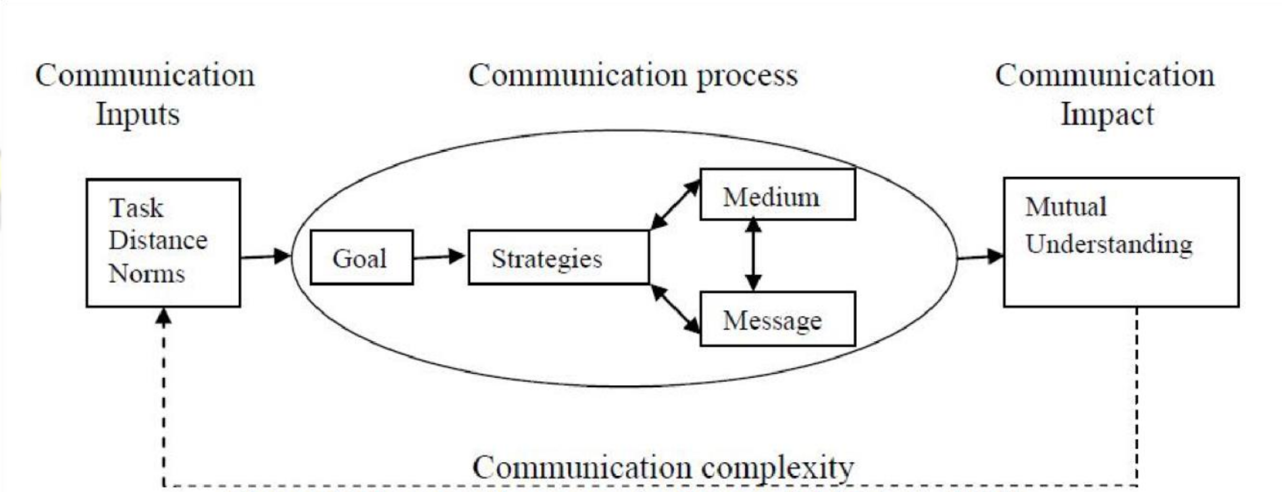

Figure 3.3: The Te'eni, (2001) Communication model

Te'eni (2001) noted that, the ability of the communicators to exhibit equal level of understanding to the information communicated as well as giving accurate feedbacks greatly rely on the deep understanding of the context (project environment), contextual knowledge and skills for the communication actions. Admittedly, these are attributes perceived to have the propensity to reduce the complexities in the communication context

(Te'eni, 2001). This is because, a reduction in communication complexities results in acceptable effective communication among the team and also increases the level of understanding and relationship among the team (Te'eni, 2001).

From the above communication models, the main key components or the elements of the communication process are presumed to be the communicators (senders and receivers), the channel and networks, medium for sending the message, and the message to be shared. Theoretically, the construction project delivery significantly depend on effective communication involving a typical interaction process of multidisciplinary teams, and an exploration process of artefact contexts, design contexts, and technical and scientific knowledge. Communication effectiveness and teamwork on construction projects can be improved by a clear understanding and knowlodge of project attributes and adapting communication planning, strategies and management to project context and charateristics of project typologies that depend on the main elements of the communication process such as senders, receivers, medium and the message.

3.5.2 The Sender and Receiver in Communication Process

The sender and receiver remain the human factors in any communication process (Marshall-Pointing and Aouad, 2005). The human communication process in a typical construction or organizational setting starts with the 'sender' encoding a message through an acceptable medium or channel and completes with the 'receiver' decoding the message for mutual benefit with a feedback.

3.5.2.1 The Sender

In a basic communication model, the sender is conceived as the individual, group or organisation that initiates the communication process (Emmitt and Goorse, 2007; Otter, 2005). It is also referred to as the source or the originator of the communication (Otter and Emmitt, 2007 & 2008; Gorse and Emmitt, 2007). In this sense, it is postulated that, the effectiveness of the communication largely depends on the ability of the communicator to adapt the necessary contextual communication behaviours, skills and knowledge to precisely encode the message to attract a least effort from the decoder to successfully decode the message for the mutual benefit (Reeta and Neerja, 2012; Gorse and Emmitt, 2007; Salleh, 2008; Keyton, 2011). It also greatly depends on their ability to choose and control the medium and channel to complete the communication process successfully (Xie, 2002; Bagarić and Djigunović, 2007; Henderson, 2004 & 2008). Senders may adopt both or either verbal or non-verbal communication style in any situation to convey the message in the best way understandable to the receiver (Gorse, 2006; Gorse and Emmitt, 2005; Otter, 2005).

3.5.2.2 The Receiver

The communication process is never complete without a receiver successfully decoding the transmitted message and giving a feedback (Gorse and Emmitt, 2007; Dainty *et al.*, 2006; Gorse, 2006). To this end, the *'receiver'* remains very critical to the choice of the medium, the composition of the information and strategy to conduct the communication process. The ability of the receiver to successfully decode and comprehend the transmitted message as intended by the sender, greatly depends on the receivers receptivity, perception and understanding to the transmitted message (Xie, 2002; Henderson, 2008; Gorse, 2006; Otter, 2005). Additionally, it is also influenced by his knowledge of the theme or topic and understanding of the context as well as sound relationship with the sender (Gorse, 2006; Otter, 2005; Xie, 2002). Likewise, Otter and

Emmitt (2008) revealed that, poorly communicated information and lack of mutual understanding of idea largely sometimes stems from the lack of understanding of the project environment and the influence of the project characteristics and complexities. To this end, the receiver is considered by many as the most important person in a communication process especially in construction communication (Gorse, 2006; Otter, 2005; Xie, 2002).

3.5.3 The Information and Message in the Communication Process

The information in a communication process can be explained as the data and messages that are transmitted between the sender and receiver in a communication network and is considered to be a critical theoretical variable in communication analysis (Gorse, 2006;

Otter, 2005; Emmitt and Gorse, 2003). A message however is defined by Richmond and McCroskey (1992) as any verbal or non-verbal stimulus that elicits meaning in the receiver. In a communication environment, the message or information to be communicated is encoded and transmitted in the form of static document or dynamic processed data (Liu, 2009; Dainty *et al.*, 2006). According to Poole (2005) and Senescu *et al.* (2010), the information in a communication process can be classified as 'classic resource' and 'perception resource' views. In the classic resource view, the information is static and unchanging and can be created, transmitted, stored, and received by an organisation as members use the information in the same way (Poole, 2005). This can be said to be more likened to construction environment where information such as working drawings, specifications, and budgets remain relatively static for the duration of the project at the construction stage and thus used effectively unless variation order could alter it.

The "perception" driven view however considers information as more than processed data, but as dynamic, constantly evolving and often interpreted differently by different parties (Poole, 2005; Manninen, 2003). Construction information can be understood in terms of three broad categories as technical information, commercial information, and management & control information (Gray and Hughes, 2001; Hughes and Murdoch, 2001). Varying perceptions in a typical construction setting can cause confusion and uncertainties (Otter and Emmitt, 2007; Poole, 2005). Construction information that are likely to be transmitted may typically include Bill of Quantities (BOQ), Specifications, Working Drawings, Delivery Schedules, Costs, Prices, Payment Schedules, Terms and Conditions, Meeting Minutes, Submittals and Production Drawings, Change Order Status, Log, As-Built Drawings, Requests for Information, Contract Status Log, Safety Information, Daily Logs and Project Schedules, Reports etc. (Liu, 2009; Otter and Emmitt, 2008; Otter and Emmitt, 2007; Otter, 2005; Xie, 2002). However, the multidisciplinary nature of the construction process and the project team may likely cause different perceptions and interpretations of this information depending on the recipient and the context. For a successful impact of the communication on the construction process, it is thus considered critical for participants to understand and interpret the information precisely, coherently and correctly with almost the same meaning (Reeta and Neerja, 2012).

Generally, information is classified based on the function of the information (Biscaya and

Tah, 2007; Dawood *et al.*, 2002). Gluch and Raisanen (2009) and Kearns and Sabherwal (2007) contend that messages or information in a communication process can either be production information which deals with getting work done, innovation information which deals with problem solving and maintenance information which is used to solve personal problems or for institutional control. According to Eckert *et al.* (2001), production information is more structured and uses systematic procedures in coding the information. Innovation information is equivocal and is more likely to receive multiple and conflicting interpretation in any communication context (Zid, 2011; Gorse and Emmitt, 2005). Additionally, innovation information is more consistent with formal and informal communication among project participants (Liu, 2009).

Shen (1992) also classified construction information as General Information (GI) which takes the form of Project Policy documents, National Regulations on Developments, Technical and Management Reports, Administrative procedure on Projects; Project Information which is divided into Organisation Information (OI) and Management Information (MI). The OI includes Design and Drawing Documents, Bill of Quantities (BOQ), Management Porgramme, Procurement and Material Control Document, Cash flow Document, Health and Safety Document, Site Technical Document, Contract Documents; whereas the MI takes the form of Progress Reports, Drawing Management, Change Request/Order, Master Plan, Site Layout, Material Conformity Report, Material Delivery and Control Report, Quality Plan, Communication Management Plan, Planning and Schedule Plan, Meeting Reports, Progress reports, Payment plan & Reports, Cash flow reports, Sub-contract Documents & Reports, Information Register, Instruction Register, Rework & Delay reports etc. Hence it is contended that, consistency is crucial in the sharing of these types of information among the team as well as clear understanding and knowledge of the project context and attributes to engender mutual understanding.

3.5.4 Identifying the Communication Linkages, Channels and Networks

Communication Linkages are also referred to as the communication channel/ networks. It refers to the informal and formal conduits that are suitable and complementary to an organization through which information or message flows from the sender to the receiver in a communication process (Xie *et al.,* 2010; Emmit and Gorse, 2007; Otter and Emmitt, 2007; Dawood *et al.,* 2002; Xie, 2002). In an organisational setting, formal channels are usually defined along the organizational hierarchy with information usually flowing vertically and taking the form of directives (Zid, 2011; Keyton, 2011). Transmitted messages through formal channels are explicitly recognized as official by the organisation (Zid, 2011; Keyton, 2011). Practically, construction projects, related information such as working drawings, specifications, BOQs, change orders, schedules, contract documents and reports are communicated through this channel.

Typically, informal and formal communication channels are the main forms used in organisational, team and intrapersonal communication (Otter, 2005; Eckert and Clarkson, 2004; Adler *et al.,* 2004). The Informal communication channels are also used as complimentary to formal ones (Zid, 2011; Keyton, 2011). It is argued that, sending information through informal channels also greatly contribute to organisational effectiveness and may carry information that are vital and critical towards project success (Senescu and Haymaker, 2009; Otter, 2005; Eckert and Clarkson, 2004; Adler *et al.,* 2004). In a construction environment, project teams rely greatly on both formal and informal channels for sharing project related information for the mutual benefit of the team. It is a common knowledge that, in most developing countries in sub-Saharan Africa, informal means of sharing information tend to be the predominant form used to initiate communication and this gradually changes to formal (El-saboni *et al.*, 2008; Kajewski *et al*., 2003). Informal communication may be seen as communication shortcuts, unofficial ways of receiving required information, thus avoiding overly bureaucratic channels and/or organizational gatekeepers (Zid, 2011; Adler *et al.*, 2004**)**. Murray (2000) found informal conversation constituted a key element in multi-disciplinary professional teams.

Formal communication channels on the other hand are contractually defined and dictated and thus it establishes the formal chain of linkages among the project team members (Keyton, 2011; Zid, 2011; Kester *et al.*, 2008; Keyton and Shockley-Zalabak, 2006). It also commands the linear chain of information flow during the construction process (Biscaya and Tah, 2007; Keyton and Shockley-Zalabak, 2006). Against this, it is thus critical that project teams adapt their communication linkages to the inherent project environment and characteristics to stimulate effective communication. This is underpinned by the fact that, sometimes with the unique attributes of projects and the context, construction projects tend to form complex communication network environment than business organisations (Hoezen *et al.*, 2008; Dainty *et al.*, 2006). Also, the contractual linkages among the project participants build up several communication networks (Xie, 2002). Project teams may be composed of individuals, groups of persons or groups of organisations and thus form a complex network of communication as communication takes place with each other, groups and organisations (Sennescu et *al.*, 2010; Senescu and Haymaker, 2008; Keyton and Shockley-Zalabak, 2006;). A typical communication network formed is typically influenced by the set of communication linkages among the project participants and the project environment (Ketser *et al.,* 2008;

Liu, 2009).
It is also opined that, the complexities of the communication networks and linkages among project teams impact on the effectiveness of the communication (Otter, 2005; Gorse, 2006; Otter and Emmitt, 2008). Consequently, the complexities in communication networks among the project teams are also induced by the project and organizational characteristics (Liu, 2009; Dainty *et al.,* 2006; Otter and Emmitt, 2008). It is posited that, in a typical construction process, there may exist far more complex network and linkages among the team as depicted in Figure 3.4. and that the communication network

complexities and problems increases exponentially as the project team increases in size or number with increasing degree of frequency among the team participants (Otter and Emmitt, 2008; Emmitt and Goorse, 2003; Gorse and Emmitt, 2003; Xie, 2002).

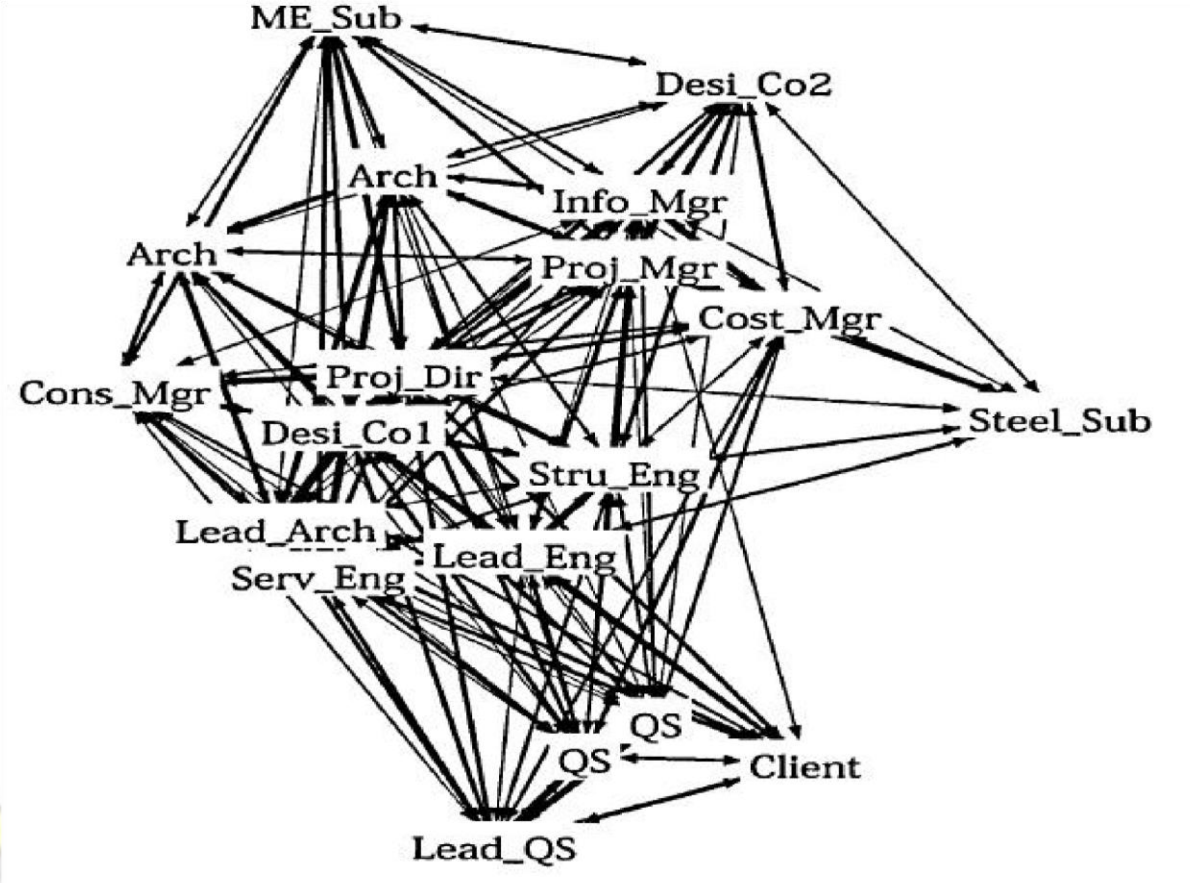

Figure 3.4: Possible Interactions in a Project Team at Construction Stage (Adopted from Xie, 2002)

Likewise, from a social network analysis conducted by Keyton (2011) and Kester *et al.* (2008), it is highly recommended that the communication network structure is evolved, analyzed and adapted to the communication context in order to ensure effective communication outcome. It is further suggested that, this action is critical and very useful to develop the required skills and knowledge and contextual understanding of the project attributes to ensure effective communication (Liu, 2009; Salleh, 2008; Murray, 2000). Keyton (2011) and Keyton and Shockley-Zalabak (2006) however indicated that, the size, density, reachability and centrality of a project team are key parameters to describe the complexity of the project team communication network. The size refers to the total number of linkages in a network and as the number of persons increases the complexity of the network increases (Liu, 2009; Keyton and Shockley-Zalabak, 2006). In centrality, the level of communication activity at each node is measured and that, this also grows in complexity with increasing participants in the team (Garton *et al.*, 1997). Monge *et al.* (1987) postulated that density and reachability of the network are critical to overcoming most barriers in a communication process in an organisation and work teams. Monge et al. (1987) views the density of the communication network as the ratio of actual to potential contacts within a network whereas the reachability of the network is defined as the number of steps that it takes to reach another person in the network (Monge 1987).

3.5.5 The Medium for Communication

The medium for transmitting a message from a sender to a receiver refers to the tool, technology or mechanisms by which the requisite message or information is sent and received (Kester *et al.,* 2008; Manninen, 2003; Xie, 2002). Several studies classify communication media in several forms in different contexts (Emmitt and Otter, 2007; Dainty *et al.,* 2006; Otter, 2005; Emmit and Goorse 2003). Dainty *et al.* (2006) classified communication media into two main types as soft and hard media and this classification was typically explained based on engineering, procurement, and construction project. Again, they explained 'hard media' to include contracts, procedure, plans, reports, policies, and regulations whereas ‘soft media’ include team building sessions, disputes, and person-to-person exchanges (Dainty *et al.*, 2006; Emmitt and Otter, 2007). It was also revealed that, hard media utilise the formal channels whereas the soft media usually take place in the informal communication channels (Emmitt and Otter, 2007; Dainty *et al.*, 2006).

Gorse and Emmitt (2007) and Otter and Emmitt (2007) revealed that, construction communication media used take two main forms as synchronous and asynchronous media. Liu, (2009) also revealed that communication media can be classified into four main groups as non-verbal media, oral media, written media and electronic media as presented in Table 3.1

Table 3.1: Types of Communication Media in Construction Projects

Non-Verbal Media	Verbal Media	Written Media (paper based)	Electronic Media
Face Expressions and cues	Face-to-face discussions	Fax	e-mail
Body language	Meetings/Discussion forum	Post	Voice mail
Speaking Tones and stresses	Telephone discussions	Bulletin	Video conferencing
			Internet and intranets

Source: Liu, (2009)

According to Otter and Emmitt (2007) and Gorse and Emmitt (2007), the comparative benefits or advantage of adopting any form of media in a communication process primarily depends on the type of message or information, the channel adopted, the communication competencies of the participants and the communication context. Remidez and Jones (2012) and Robert and Dennis, (2005) also classified communication media as lean and rich where lean communication media are asynchronous and impersonal relying greatly on rules, forms, procedures and database taking the form of post, fax, bulletin, e-mail, internet and intranet and predominantly text based. Rich communication media on the other hand refers to media suited for ambiguous or illdefined communication situations and the degree to which the message is personalized and normally take the form of meetings, face-to-face conversations and video conferencing (Liu, 2009; Otter and Emmitt, 2007; Gorse and Emmitt, 2007; Robert and Dennis, 2005). Both types rely greatly on the language skills of the communicators to effectively achieve mutual communication performance among the team as well as the suitability of the communication context.

3.5.5.1 Written Media

Literature confirms two main media used in project team communication as written and oral (Otter and Emmitt, 2007; Otter, 2005; Emmitt and Gorse, 2003). The written media take the form of post, fax, e-mail, intranet, internet and groupwares (Otter and Emmit, 2007). The written media are most often contractually supreme to oral media in construction project environment and further strengthen that where oral communication is used, it must be confirmed in writing to aid effective documentation and refence (Otter and Emmitt, 2008; Otter, 2005).

3.5.5.2 Oral Media

The oral media take the form of face-to-face discussions, video conferencing and telephone conversation. In practice, these are often non paper based but to have contractual significance, it is further confirmed in writing after the discussions. In the construction industry, often oral communication is used for clarification and remains very dominant in clarifying communicated information in reports, instructions, specifications, drawings etc (Emmit and Gorse, 2007; Gorse, 2006; Otter, 2005).

3.5.5.3 Lean and Rich Media

In a study by Robert and Dennis, (2005), it is opined that 'lean and rich' are key critical characteristics of communication media that have high potential to impact on the communication performance. It can be said that the 'lean and rich' media may complement each other to aid the communication process; its choice and dominance usually depends on the time, context and nature of communication as seen in Table 3.2 below.

Table 3.2: Hierachy of Communication Media Characteristics

Media		Characteristics		Media Richness	Best for Communications that are:
		Feedback	Cues and Channels		
Face to Face	Oral	Immediate	Audio & Visual	High	Ambiguous, emotional divergent background
Telephone		Rapid	Audio & Visual		
Addressed Documents	Written	Slow	Limited Visual		
Unadressed Documents		Slowest	Limited Visual	Low	Clear, rational , official similar backgrounds

Source: Robert and Dennis (2005)

Lean communication media usually consist of text based communication and includes emails, post, internets and intranets whereas oral based communications such as face-toface meeting and discussions, video conferencing and telephones are classified as rich media (Emmitt and Otter, 2007; Otter, 2005; Xie, 2002). In a study by Robert and Dennis (2005), it is emphasised that both rich and lean media have their merits and demerits and that a blend to suit a communication context is critical. They reviewed the media used in communication as presented in Table 3.2 and stressed that, often the need for feedback, context, form of communication are critical in the choice of communication media. In their analysis, oral communication have high media richness as against written with very low or lean media richness and slow feedback.

3.5.6 Feedback in Communication Process

It is often asserted that *feedback* remains the most critical component of a communication process which enables a sender to know whether the message sent has yielded the required impact, understanding and attained the desired goals (Dainty *et al.*, 2006; Xie, 2002). It is defined by Dainty *et al.* (2006) as the message that is transmitted by the receiver to the sender to confirm the receipt of message from the sender and thus completes the communication process.

In this regard, it implies that without feedback, communication is said to be incomplete. In a typical communication process/or model, feedbacks potentially aid recipients of the message or information to request for clarity and further particulars to help decode and use the transmitted messages and enable the receiver send response to the sender (Dainty et al., 2006; Otter and Emmitt, 2007). The feedback sent from the receiver to the sender can take a verbal written form or non-verbal form (Xie, 2002). In the abscence of feedbacks, it is always impossible for senders to know if the sent or transmitted message in the communication process has been received and understood correctly (Xie, 2002; Otter, 2005; Otter and Emmitt, 2007).

According to Gorse (2006) and Otter (2005), the nature and premium placed on feedback to complete the communication process will vary based on the interactive concept, effective concept and active concept. In the *interactive concept* where there is back and forth process between sender and receiver(s) with changing roles such as in a dialogue, telephone conversation or group meetings, feedback is essential for communication whereas in *effective concept* where the nature of communication is a one-way process with a highly active sender and passive receiver(s) and with anticipated predictable reaction, the feedback is possible but not extremely expected as in the case of sent postal mail, facsimile, and paper project dossiers. In an *active concept* however, an active oneway process of a sender sends message to diffused receivers through radio or television broadcasting, publishing of information to receivers, feedback is difficult to achieve through the same medium. In this regard, the feedback given to the sender will naturally depend on the type and nature of communication adopted between the sender and the receiver (Otter, 2005) and that plays a major role in effective communication performance.

3.5.7 Barriers and Filters in Communication Channels

Organisational and construction communication are often beset with several barriers that impact greatly on the effectiveness of the communication among the project team (Azmy, 2012; Liu, 2009; Dainty *et al.*, 2006; Xie, 2002; Mead, 1999; Thomas *et al.*, 1998). In the view of Xie (2002), barriers and filters refer to challenges and actions that impair the delivery and understanding of communicated information through the adopted channel. Several Studies have outlined information overload, underload, gatekeeping, distortion or filtering, and accessibility, timeliness, procedures, gate keeping as the notable barriers and filters in organisational and team based communication (Xie, 2002; Murray *et al.*, 2000; CII, 1997; Thomas *et al.*, 1998; Shen, 1992). Practically, these indicators outlined above have emerged as the indicators for assessment of communication effectiveness especially in the construction industry.

Xie (2002) suggested that, for contractual reasons or otherwise, *gatekeeping* which is when project participant intentionally withholds information from others is a major barrier affecting project team communication performance in project based organizations. This is because, often due to the wide multi-disciplinary nature of project teams and varying requirements to project information, it is difficult to know which information is relevant to which participants and this leads to some information being withheld on grounds that it may not be relevant to other participants. In the case of d*istortion*, the nature of the message or information is changed inadvertently or intentionally by adding and deleting information being communicated (Thomas *et al.*, 1998; Liu, 2009). According to Murray *et al.* (2000) a*ccessibility* which refers to the ease with which people can retrieve and process pertinent project information remains a challenge to construction project teams.

Also, Gluch and Raisanen (2009) and Otter (2005) noted that, lack of clear lines of authority and clear structure that mandates how firms will communicate in interorganisational settings remains a huge barrier to effective communication in organisations and among teams. They further posist that, inter-organisational communication can be improved by establishing a set of flexible rules that will help govern how information is communicated and utilized during the course of a project and also improve the skills needed to perform the communication among the team (Gluch and Raisanen, 2009; Otter, 2005). Zid (2011) and Robert and Dennis (2005) also revealed that, most of the barriers in project based communication process could be reduced by applying strategic skills in planning the project information. Additionally, conformance to formal arrangements, controlling the communication among the project team and adapting to the project characteristics are more likely to reduce barriers (Zid, 2011, Otter and Emmitt, 2008). In the context of emerging complexity of construction projects and project characteristics in recent times, coupled with the multidisciplinary participants' involvement especially in projects of unique characteristics such as MHPs, there are several potential human, technical and contextual barriers that can greatly influence the effectiveness of the communication process and these must be pursued.

3.6 HUMAN AND TECHNICAL FACTORS IN COMMUNICATION

In a typical communication model as in Figures 3.1 & 3.2, two main components can be identified as critical to the communication process. These are the sender and receiver and the medium or technical tool used as well as the communication context and emvironment. The 'Sender and Receiver' are thus referred to as the human factors in a communication model whereas the medium or the technical tool and context are referred to as the technical factors of the process (Liu, 2009; Dainty *et al.*, 2006; Gorse, 2006; Otter, 2005).

3.6.1 Human Factors

The 'senders and receivers' in a communication process are perceived as the human factors that greatly impacts on the effectiveness of the communication among the project team or participants (Yang *et al.*, 2007; Otter, 2005; Marshall-Ponting and Aouad, 2005). Calls for improvement in communication performance in the construction industry have generated arguments as where the emphasis should be, to register the needed improvement being advocated (Liu, 2009; Hoezen *et al.*, 2008; Xie, 2002). MarshallPonting and Aouad, (2005) opined that, the key or critical aspect leading to communication performance improvement is to focus on two distinct areas of the human factors or the technical factors or both in the communication process. They emphasized that, the focus on the human factors aspect of the communication process is key and thus should encompass the behaviours, skills, the project settings and attributes. The human factor determinists suggest that, technology only plays an enabling role in communication and thus does not really improve communication but rather a holistic improvement in the behavioural actions of the human players and communication context undoubtedly improve communication (Marshall-Ponting and Aouad, (2005).

It is also affirmed that, project management practice is skill based and thus knowledge of the context of project delivery and understanding of the project characteristics is crucial (Cegielski *et al.*, 2008; Yang et *al.*, 2007; Otter, 2005). Likewise, appropriate contextual communication skills are critical project management attributes required for effective communication in the construction process (Dainty *et al.*, 2006; Adler *et al.*, 2004). In considering the factors that affect the communication among teams, it can be suggested that the impact of the factors on the effectiveness of the communication can be determinate. However, the difference in the level of the communication outcome will depend on the communication skills of the human factors doing the contextual communication. This is because the accurate encoding and decoding of the messages in a communication process greatly depends on the experience, skills and the knowledge of the communication participants (Salleh, 2008; Henderson, 2004 & 2008).

This argument is underpinned by the theoretical assumption that, when project participants are well aware of the communication challenges inherent from the project typologies and the project environment, they are more able to develop and adapt skills, strategies and concepts necessary to stimulate an acceptable communication outcome. To this end, Salleh,

(2008) and Henderson (2008) intimated that, organisational and construction communication lies in the human behavioural domain and that, the effectiveness of any communication in any setting will primarily depend on the influence of contextual communication skills and knowledge of the communication process and context (environment).

3.6.2 Technical Factors

The tools and technology adopted to aid communication and the communication context (environment) are perceived as the technical factors in the communication process (Yan, 2009; Yang *et al.*, 2007; Otter, 2005; Mead, 1999). Practically, in construation and other related context, Information Communication Technology (ICT) has widely been denoted as the technical factor in a communication process (Yan, 2009; Yang *et al.*, 2007; Otter, 2005; Mead, 1999). Even though ICT has well been acknowledged as very useful in improving communication, for a fact, its application has had huge impact in the organization and construction communication process (Emmitt and Otter, 2007; Yang *et al.*, 2007; Dainty *et al.*, 2006; Otter, 2005; Mead, 1999). The application of ICT to a communication process impacts the organizational networks by changing the frequency and direction of flow of information and circumventing the traditional chains of command (Yan, 2009; Yang *et al.*, 2007; Otter, 2005). It also affects the communication structure by moving groups from a rigid mechanistic structure to a connected, flexible organic framework (Otter, 2005; Shenhar, 2001). Also, the use of ICT in construction communication also impacts on communication among diverse, multi-disciplinary teams by establishing inter-organisational linkages and inter-personal relationships (Mead, 1999; Otter, 2005; Yan, 2009; Yang *et al.*, 2007).

From both practical and theoretical perspective, it is well accepted that, the adoption, application and impact of ICT to the communication process in the Construction Industry is well acknowledged. It has potentially induced positive effect on the timeliness and understanding of project information among the project team (Yang *et al.*, 2007; Dainty *et al.,* 2006; Mead, 1999; Baldwin *et al.*, 1996). Inspite of this positive effect of ICT to the communication process in the industry, it is also acknowledged that, its use contribute to information overload among the project participants (Xie *et al.*, 2010; Xie, 2002; Mead, 1999). It is further contended that, the success of the application of ICT in a communication process to enhance communication effectiveness among the team primarily depends on the human factors of the communication interactions (Dawood *et al.*, 2002; Xie, 2002; Murray, 2000: Mead, 1999). Additionally, it also depends on adopting the type and use of ICT to the project chracateristics and challenges (Dawood *et al.*, 2002; Xie, 2002; Mead, 1999).

To this end, it has been further suggested that, to improve communication performance in the construction process, the view from technical approach believes that *'technology'* is the single most significant factor to enhance communication performance (MarshallPonting and Aouad, 2005; Gorse and Emmitt, 2003; Dawood *et al.*, 2002). This assertion has been challenged by the argument that ICT does not perform the communication but rather it enables the process (Marshall-Ponting and Aouad, 2005; Gorse and Emmitt, 2003; Xie, 2002; Mead, 1999). Also, the said ICT is operated by the communicator so the focus should be on the user of the ICT and the understanding of the project context or environment (Otter, 2005; Marshall-Ponting and Aouad, 2005; Xie, 2002). This argument is underpinned by the fact that, for example, in using the internet to share information among the team, the internet does not create the information but rather facilitate its sharing. In this sense, the ability of the internet to send accurate information rather depends on the skills of the sender than the efficiency of the internet service (Dainty *et al.*, 2006; Otter and Emmitt, 2007; Mead, 1999; Emmitt and Gorse, 2003).

Hence, it is generally agreed that, in a bid to improve communication among the team, attention and focus must be on the skill and knowledge of the team participant and a good level of awareness of the contextual nature and varied characteristics of projects rather than the ICT tools (Otter and Emmit, 2007; Otter, 2005; Marshall-Ponting and Aouad, 2005; Manninen, 2003). It is also established that the critical challenge to the use of ICT in the construction industry not yielding its full benefit is due to managerial and skills factors, multi-disciplinary nature of the project participants and the varied project attributes and characteristics (project typologies) (Yang *et al.*, 2007). It is emphasised that these factors inhibit the full adoption of generic tools in the collaborative work nature across all domain professional services and all project typologies (Yang *et al.*, 2007).

3.7 THE NATURE AND ENVIRONMENT FOR COMMUNICATION ON CONSTRUCTION PROJECTS

The construction industry and project environment are highly fragmented and lacking effective coordination which consequently affect performance and delivery success (Parker, 2008; Hyvari, 2006; Polzer *et al.*, 2002). The process is also perceived as being highly human related with temporary participation in a constantly changing and dynamic environment (Baiden et al., 2011 & 2006; Emmitt and Gorse, 2007; Dainty et al., 2006). The construction project process is also said to be very collaborative, dependent on nature involving multi-disciplinary professionals with varying and competing goals and motives which drive their contribution to the process (Parker, 2008; Love *et al.*, 2002). Against this gackground, effective communication among these multi-disciplinary professionals is critical to overcome this fragmentation and volatile situation (Hassall, 2009; Ibrahim *et al.*, 2011; Azmy, 2012). Further to this, it is also generally agreed that, the nature of construction projects requires the involvement of a wide range of different activities and specialist participants at the various phases and that effective sharing of information is crucial to the survival of the project and the team (PMI, 2008; Karlsson *et al.*, 2008; Uher and Loosemore, 2004).

It has been suggested that, the communication needs in a construction project environment differ significantly among the project participants depending on who is involved in the tasks, who needs the said information and for what and which information is necessary and will easily be understood (Kajewski *et al.*, 2003; Loosemore and Lee, 2002; Loosemore and Tan 2000). In the construction environment, issues related to poor communication and information transmission have been identified as the cause of most of the performance problems and central to this is the lack of the needed skills and understanding of the project characteristics to undertake this task in this unique environment (Katzenbach and Smith, 2005; Kajewski *et al.*, 2003). This necessitates that, for effective communication performance in such environment, it is critical for the verbal, non-verbal, formal and informal communication to be handled with exact dexterity and adapted to the project attributes and environment to meet the intended goal of the communication among the participants.

3.7.1 Communication Forms on Construction Projects

Communication classification has taken several forms depending on the context, function, type of communicators involved and the environment (Emmitt and Gorse, 2007; Dainty *et al.*, 2006; Gorse, 2006). The appropriate choice of any form of communication will most likely depend on the type and nature of information to be transmitted, the recipients involved and the expected desired communication outcome (Otter and Emmit, 2007 & 2008; Dainty *et al.,* 2006; Loosemore and Lee, 2002). In the construction industry, communication among the project team takes the form of synchronous and asynchronous communication (Otter and Emmit, 2007), inter-personal, intra-personal, interorganisational, multi-organisational and mass communication (Otter and Emmitt, 2007; Otter, 2005; Emmit and Gorse, 2003). Also communication in the industry can take the form of verbal, non-verbal, formal and informal (Gunhan *et al.*, 2012; Maier *et al.*, 2008). It can be stressed that in the context of the construction industry and more specifically among the project teams in a construction process, all these forms of communication are used depending on the goal, context, people involved, the nature of the information to be communicated and project characteristics.

3.7.1.1 Formal and Informal Communication

Human communication practised in the construction industry takes both formal and informal forms across the various phases of the project life cycle. In developing countries, informal communication is dominant over formal communication at the construction stage (Ochieng and Price, 2010; Diallo and Thuillier, 2005). It is further suggested that, it is through informal transmissions that real communication occurs during the course of a construction project (Maier *et al.,* 2008; Robert and Dennis, 2005; Mead, 1999). Formal communication usually takes the form of written document, reports, instructions etc. for the purposes of progressing the project with accurate information. It is normally shared by post, e-mail and personal delivery to participants. Informal communication normally takes the form of face-to-face discussions, telephone or video conference discussions and is often unwritten (Otter and Emmitt, 2007 & 2008; Gorse, 2006; Otter, 2005). It is often shrouded with unclear contents where further explanations are most at times required. It is usually the fuel for confusion and conflict as proper record of documentation is not made (Diallo and Thuillier, 2005).

3.7.1.2 Non-Verbal and Verbal Communication

As often described, communication may be defined as a dynamic transaction of simultaneous exchange of verbal and non-verbal messages, resulting in shared meaning between two or more people (Gunhan *et al.*, 2012; Staley, 1992). In a communication setting, non-verbal messages take the form of information transmitted from one person to another via facial expression, tone of voice, gestures, movements and touch (Gorse, 2006; Poole, 2005; Xie, 2002). According to Gunhan *et al.* (2012), non-verbal cues play a significant role in communication and enhances understanding during face-to-face meetings and discussions. Non-verbal communication messages are behavioural laden which may be direct or indirect, conscious or unconscious and can reinforce verbal messages communicated depending on how it is interpreted (Salleh, 2008; Dainty *et al.*, 2006; Murray, 2000). According to Dainty *et al.* (2006),non-verbal communication are extensively used in construction communication and thus the dynamic nature of the project environment is a major challenge to attaining effectiveness of the communication. In the light of this, it is critical that the appropriate skills are employed to rightly conjure the cues that facilitate the effective communication when necessarily used on construction projects.

Verbal messages are represented in the spoken aspect of communication and are considered as the most direct form of communication (Otter and Emmitt, 2007; Gorse, 2006; Dainty *et al.*, 2006; Otter, 2005). Exchange of information through this form is very prevalent in construction process especially through face-to-face meetings, telephone conversation and video conferencing (Liu, 2009; Otter and Emmitt, 2007; Otter, 2005). Also verbal communication in construction can be formal and informal and its acceptance is mostly dictated by contractual arrangements (Liu, 2009; Gorse and Emmitt, 2007; Dainty *et al.*, 2006). Verbal communication through conversation and discussions are considered the most effective way of sharing project related information among project participants (Dainty *et al.*, 2006). Against this, it is considered crucial for persons to possess the requisite skills to be precise, accurate as well as right interpretations to register mutual understanding among the project team (Reeta and Neerja, 2012;

Henderson, 2008; Dainty *et al.*, 2006).

3.8 THE CONCEPT, TYPES AND COMPOSITION OF PROJECT TEAMS

The concept of teamwork evolved from the industrial revolution era as a paradigm for optimizing the way tasks were performed so as to make workers more efficient and enhance output (Levi, 2007; Baiden *et al.*, 2006). Levi (2007) further indicated that, applying team work is an appropriate way to improve the operations of organizations and productivity. Applying the teamwork approach was very common in the manufacturing and business sector than the construction industry and became the foundation for organizations until the turn of late 1980s (Azmy, 2012; Uher and Loosemore, 2004). In the construction industry, the focus on teamwork approach has been to determine better ways to enhance output and performance (Azmy, 2012; Liu, 2009; El-Saboni, 2008; Demkin, 2008; Kayworth and Leidner, 2002). However ‘teamwork is no longer applied only to manufacturing, but also to management, service delivery, problem-solving, projects, and other works' (Azmy, 2012, pp.3).

In recent times, the focus of team research has been on the behavioural aspects of teams towards effectiveness, integration, relationship, coordination and collaboration to increase the benefits of teamwork approach (Azmy, 2012; Baiden and Price, 2011; Gittell, 2011; Senescu *et al.,* 2010; Trautsch, 2003). Against this, studies continue to identify and emphasized communication as the critical element to achieve this objective (Azmy, 2012; Baiden and Price, 2011; Senescu *et al.,* 2010; Hassall, 2009; Baiden *et al.,* 2006).

3.8.1 Definition of Project Team

The definition of project team is often one of an ambiguous endeavour as the term could be applied in different and several contexts. From related literature, the term team, construction team, construction project team, project management team, project team, design team, construction engineering team, management team and organizational team have all been used but may be performing same or similar function and remains quiet undifferentiated (Azmy, 2012; Senescu *et al.*, 2010; Cantu, 2007; Liu, 2009; Gorse and Emmit, 2007; Otter, 2005; Diallo and Thuiller, 2005; Trautsch, 2003). In the context of this study, the term shall be limited to *'construction project team'*. Trautsch, (2003), defined project team as a group of people or persons organized to work together to achieve a goal. It has also been defined as a temporary, multi-disciplinary and network based organizations of collaborating specialist on a common project (Otter, 2005). Gorse and Emmit (2007) also elaborated on this by defining project team as a loose grouping of interested parties and/or organisations functionally collocated by tasks for a specific construction project.

Contextually in a project environment, project teams constitute two or more individuals, related interdependently to perform relevant tasks, share goals, interact socially, maintain and manage boundaries, and exist within an organizational context (Kozlowski and Bell 2003). According to Guzzo and Dickson (1996), the term project team insinuates a larger social system, such as organization as project tasks have developed beyond the capacities of individuals and become team focussed. The crux of this study is on construction project, more specifically MHPs. The nature of MHPs draws on group(s) of persons or organizations performing professional function on the project. To this end, the term project team shall be used to mean a multi-group of professionally oriented organisations with a shared common goal of delivering construction housing projects with the complimentary skills, shared goals and last for the duration of the housing project.

3.8.2 Types and Nature of Project Teams

Today's emerging projects have called for new paradigms in team compositions as well as locations of project teams. The operational, organisational tasks, procedures and other management activities associated with emerging construction projects have recognized a shift in the traditional approach to team function (Uher and Loosemore, 2004; Kajewski *et al.*, 2003). To this end project teams have thus been classified differently based on the geographical proximity to the task location on the project (Azmy, 20012; Kajewski *et al.*, 2003; Trautsch, 2003; Kayworth and Leidner, 2002). Typical construction projects involve the collaboration of a number of organizations (teams), which are brought together for the duration of the project to form the 'project team' (Levitt, 2007; Alshawi and Faraj, 2002; McDonough *et al,*. 2001; Maybury *et al.,* 2001). This team formed for the purposes of the project maybe collocated or geographically dispersed (Levitt, 2007; Alshawi and Faraj, 2002; McDonough *et al,*. 2001). McDonough *et al.*, (2001) in a study on classification of project teams determined three main types. This was also confirmed by Trautsch, (2003). Their studies determined project teams as *traditional, virtual and global*.

3.8.2.1 Traditional Project Teams

McDonough *et al.* (2001) perceived project teams collocated in the same geographical or physical location and are often culturally similar as traditional teams. It is also referred to as collocated team (Trautsch, 2003). This type of project team shares an advantage of having face-to-face contacts or interactions regularly among and between the team participants (Trautsch, 2003). Uher and Loosemore (2004) contended that professional rivalry and technical professional languages remain the greatest challenge to communication among this type of team and as such communication language and diction must be kept at the barest to effectively aid the mutual understanding of all participants.

3.8.2.2 Virtual Project Teams

A virtual project team or distributed project team is defined by Trautsch, (2003) as a project team whose participants or members working together on a specific project are geographically dispersed and their tasks are non-routine. According to McDonough *et al.* (2001), a virtual project team is composed of group of individuals or organisations with moderate level of physical proximity and maybe culturally similar. Virtual project teams have the propensity to improve cycle times, reduce travel cost and redundancies across organizational units (Kayworth and Leidner, 2002). Given the dispersed nature of virtual project teams, achieving effective communication performance remains its major challenge

(Kajewski *et al.,* 2003; Trautsch, 2003; McDonough et al 2001). To this end, it is contended that, such teams will require unique complementary communication skills to aid effective communication across all dispersed locations (Katzenbach and Smith 2005; Kayworth and Leidner, 2002). In a typical project environment such as the construction industry, any varying degree of dispersion among the project team has a negative impact on the degree of trust, cooperation and collaborative tasks among the team (Ochieng and Price, 2009 & 2010; Diallo and Thuiller, 2005; Kayworth and Leidner, 2000). Against this, effective communication has been determined as critical to moderate such effects (Keyton, 2011; Ochieng and Price, 2009; Henderson, 2008).

3.8.2.3 Global Project Teams

This type of project team involves group of individuals or organisations who are involved in a common project but are living in different countries and are culturally diverse (McDonough et al 2001). In other studies, they are referred to as a high level of virtual team (Trautsch, 2003; Kajewski *et al., 2003;* Hassall, 2009). This form of project team presents a higher level of communication challenges in sharing project information both in skills and technology.

Practically on mass housing projects, project teams may involve multi-disciplinary individual professionals or organizations on several collaborated tasks that may be collocated and dispersed. Typically, from a practical and theoretical perspective of mass housing delivery in Ghana, project teams managing the housing projects could be composed of professional participants entirely from the real estate organization or a mix of professionals from the real estate organization and outside the organization or entirely professionals from outside the real estate organization. Additionally, these participants or their representatives may be located on site or as and when needed on site or norminally visit and inspect progress of work. Against this background, project teams in the context of this study shall include both traditional and virtual member organizations that may even be outside the geographical boundaries of the project location.

3.8.3 Composition of Project Teams

One of the vaguest construct in project team is what constitutes the appropriate members of the team for a given project. In several studies, a typical construction project team included Project Manager(s), Architect(s), Quantity Surveyor(s), Engineer(s), Contractor(s), Specialized Contractor(s) and Suppliers and Client as members (Azmy, 2012; Hoezen *et al.*, 2008; Uher, and Loosemore, 2004; Xie, 2002). However, it is sternly suggested that, the composition of any project team will however depend on several factors. Studies by Azmy, (2012), Senescu *et al.*, (2010), Baiden *et al.* (2006), Uher and Loosemore (2004), Cornick and Mather, (1999), confirm that, the size and composition of suitable project team for any project will be influenced by size and type of project, project attributes, the delivery methods required, the management approach adopted, nature and type of client, the complexity of the project and the nature and types of tasks involved.

It is also asserted that, the construction project phases also have a significant impact on the formation of project teams (Uher and Loosemore, 2004; Cornick and Mather, 1999). They further posisted that, the tasks and functions of each phase of the construction project vary and thus will be performed by different set of team members for each phase.

Against this, Uher and Loosemore (2004) listed a typical project team to include client, Project Manager, Financier, Legal Consultant, Design Leader (Architect or Structural Engineer), other Design Consultants, Main Contractor, Subcontractors, Cost Consultant, other Consultants (depending on project needs) and an end user of the completed project (where appropriate). Liu (2009) identified a project team for a government construction project as Developer (client), Design team, Main contractor, specialized sub-contractors, specialist consultant, Government representative, suppliers and any third party guarantor.

From the perspective of Cornick and Mather, (1999), the functions and tasks at the construction stage conventionally include design and construction monitoring, contractor and specialist works (see Figure 3.5). This could define the project team composition as client representation, designer, construction manager, contractor, sub-contractor etc.

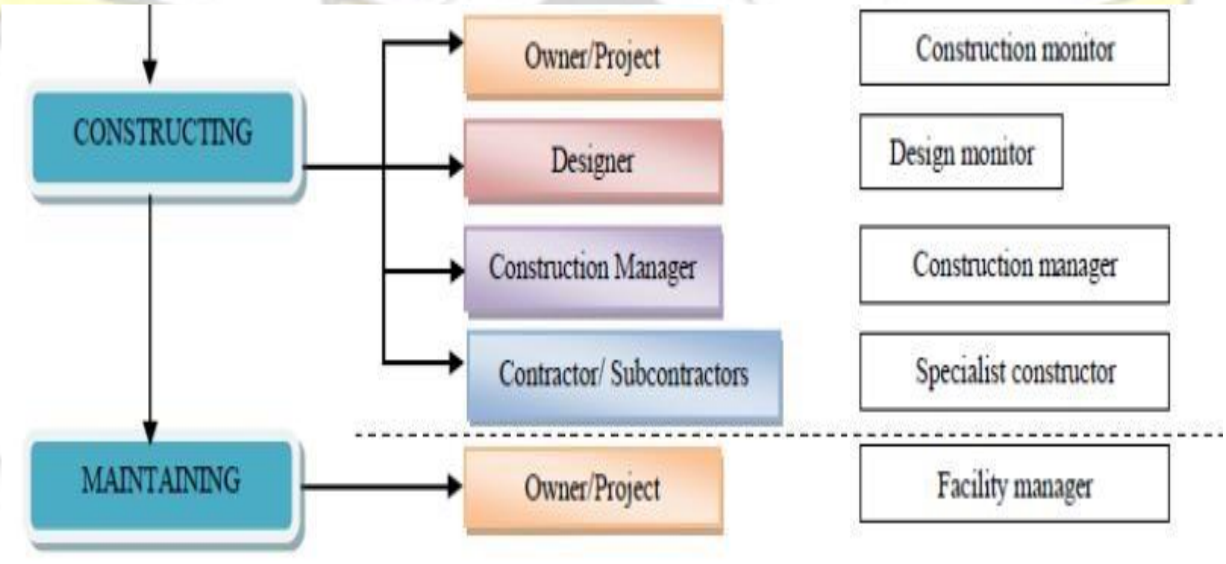

Figure 3.5: Project Team at the Construction Stage. Adopted from Cornick and Mather (1999)

Zairul and Rahinah (2011) and Enshassi (1997) indicated that, mass housing projects often adopt a project organization form that manages the series of packaged housing units under individual contractors and sub-contractors. It is further espoused that, often varying site organisations and supervision concepts are adopted by the different managing contractors on the various housing contract packages (Enshassi, 1997; EL-Rayes *et al.*, 2000; Ahadzie and Amoa-mensa, 2010). From the practical and theoretical perspective of the Mass Housing delivery in Ghana and other developing countries, traditional method, construction management, project management or contract management approaches are the dominant management concept adopted (Ahadzie and Amoa-Mensa, 2010). Hence, the project team usually depending on the management concept adopted will compose of client organization (real estate organization), Project Panager (PM), Estate Manager,

Architect, Quantity Surveyor, Civil/structural engineer, Main Contractor(s), Specialist

Sub-Contractor(s) and Nominated and Domestic Suppliers.

3.9 COMMUNICATION AMONG PROJECT TEAM

Project team communication involves the generation and compilation of all processes for sending and receiving messages between and/or among the participating team members both individually and collectively using the available means of communication (Dainty *et al.*, 2006; Eckert and Clarkson, 2004; Dawood *et al.*, 2002; Eckert *et al.*, 2001). Construction project teams use varied and multiple forms and media to share project related information among participants. The project team participants form a complex web of communication networks and relations as shown in Figure 3.6.

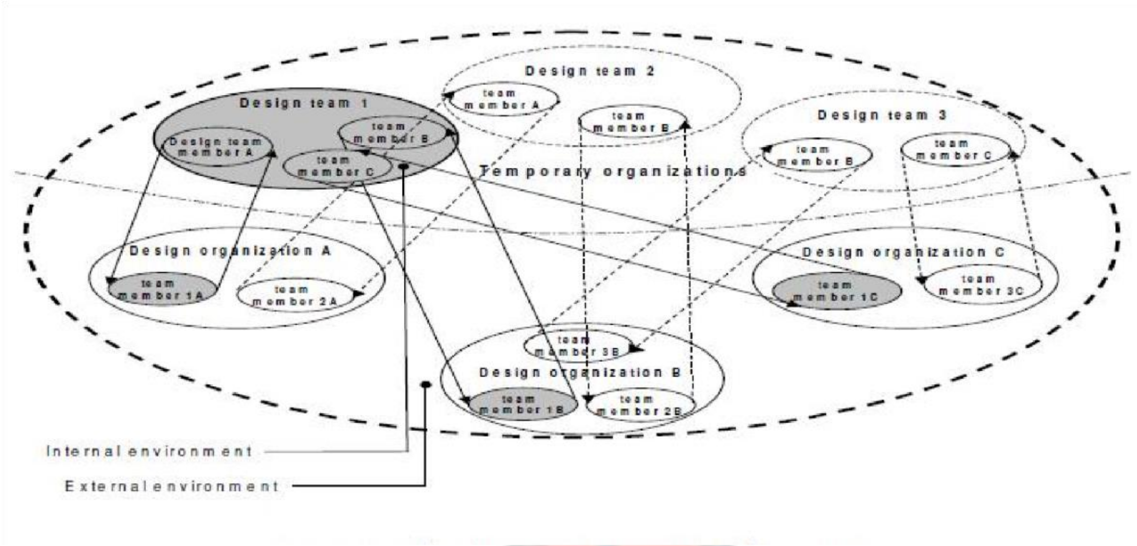

Figure 3.6: The communication Information Environment for Project Team

(Source: Otter, 2005)

Communication is critical to the success of construction project teams towards maximizing the output of the teams as well as ensuring high level effectiveness (Eckert and Clarkson, 2004; Thomas *et al.,* 1998). To this end, Otter and Emmitt (2008), Gorse (2006) and Otter (2005) asserted that, the communication process of transference and exchange of project related information between the sender(s) and receiver(s) must attain a mutual understanding. Maier *et al.* (2008) and Otter and Emmitt (2007) also contend that, team communication is a social and cognitive process where project related information or messages are transmitted through accepted medium from sender to receiver to gain a response. Against this, Otter and Emmitt, (2007) suggested that, project teams must use various forms of asynchronous and synchronous communication depending on the time, place and premium placed on feedbacks, interactions and formal or informal context that adapt to the project contraints and challenges.

Communication within the project team is considered very critical for the smooth progress of the construction projects by providing the team participants with communication supporting tools and platforms for their stable collaborative tasks and functions such as planning, progress monitoring, coordination, and control (Maier *et al.*, 2008; Otter and Emmitt 2008; PMI, 2008). It is also seen as a core indicator for increased project team integration and effectiveness on construction projects towards enhanced performance and outcome (Cheng *et al.*, 2010; El-Gohary and El-Diraby, 2010; Ochieng and Price, 2009; Baiden *et al.*, 2006). Communication performance among a multi-disciplinary team remains the major critical challenge that accounts for many project failures (Azmy, 2012; Otter and Emmitt, 2008; Otter, 2005). The failure of project team to adapt the communication to the management characteristics and project attributes usually accounts for the team communication break down (El-Gohary and El-Diraby, 2010; Anumba and Duke, 2007; Anumba and Evbuomwan, 1999).

Communication and information exchange among the project team may take the form of face-to-face mode and through electronic tools (Otter and Emmitt, 2007 & 2008). The most commonly adopted form is face-to-face communication among the project teams which often take the form of dialogues and meetings, and at a distance by using telephones, cell phones, video-conferencing and instant messaging (Liu, 2009; Otter and Emmitt, 2007; Dainty *et al.*, 2006; Xie, 2002). The efficiency and effectiveness of the communication means is influenced by the nature of the project, project organisational environment and communication behaviours of the team (Otter and Emmitt, 2007; Gorse and Emmitt, 2007 & 2003).

3.9.1 Effective Communication among Construction Project Teams

Effective communication refers to the giving of accurate and understandable information and receiving and understanding the message to aid the right performance of task (Xie *et al.*, 2010; Liu, 2009; Otter, 2005; Mead, 1999; Thomas *et al.*, 1998). It also refers to the degree of measure of how the communication meets its intended goal (Liu, 2009; Dainty *et al.*, 2006; Otter, 2005). It is argued that, effective communication is essential and not just in transmitting information but also in giving of mutual understanding to the information among the sender and the receiver (Xie *et al.*, 2010; Xie, 2002). Communication effectiveness is said to be very critical towards team effectiveness, managerial efficiency and organizational effectiveness, hence all attempts must be made at its improvement (Azmy, 2012; Gittell, 2011; Hassall, 2009; Diallo and Thuiller, 2005; Xie, 2002).

Several studies continue to outline various forms of communication problems prevalent among construction teams in the construction industry (see Ochieng and Price, 2009; El-Saboni *et al.*, 2008; Diallo and Thuiller, 2005; Xie, 2002; Kayworth and Leidner, 2000; Enshassi, 1997). Kayworth and Leidner (2000) indicated that communication ineffectiveness is the major challenge among virtual teams on construction projects. Ochieng and Price (2010) and Diallo and Thuiller (2005) on the other hand revealed that, cultural diversity among construction project teams intensify the communication problems experienced on the project being managed. Yang *et al.* (2007) and Vanita and Yang, (2006) established that, though the use of technology is perceived to enhance team communication, the lack of effective skills and familiarity with the technology and complex communication networks are major threats to team communication effectiveness as well as the adoption of ICT for team communication.

Likewise, Hoezen *et al.* (2008) indicated that, communication among the construction building team is an emerging area needing significant improvement. Besides, MarshallPointing and Aouad (2005), Xie (2002), Thomas *et al.* (1998) and CII (1997), have identified communication performance measures as a veritable approach to determining the factors that affect communication performance outcome. They argue that, this identification approach is deemed very crucial in evolving and adopting a spot on approach and strategies to improve the communication (Marshall-Pointing and Aouad, 2005; Xie, 2002; Thomas *et al.*, 1998; CII, 1997).

3.10 COMMUNICATION PERFORMANCE ASSESSMENT

Communication performance and it measure remains one of the most ambigious tasks to researchers and practitioners due to the wide and varied contextual nature of communication (Šafranj, 2009; Morreale, 2009; Salleh, 2008; Bagaric and Djinovic, 2007; Morreale *et al.*, 2006). Against this background, Liu, (2009), asserts that, to successfully measure communication performance, it is very critical to first contextually

define the term *'communication performance'*. Communication Performance measurement is better thought of as an overall management system involving the evaluation of the communication task performed in achieving conformance outcome and critical to this is that, it should be measurable (Morreale, 2009; Morreale *et al.*, 2006). Communication performance (CP) is differently conceptualized and operationalized in different context which within the construction industry has been an emerging area (see Xie *et al.*, 2010; Liu, 2009; Xie, 2002; Mead, 1999; Thomas *et al.*, 1998). Though these studies have lacked theoretical underpinning, they have primarily been based on the evaluation of the effect of certain factors on the performance outcome.

Theoretically, communication performance assessment has predominantly been conceived as the measure of the degree of how effective or ineffective a communication task performed is (Morreale, 2009; Gorse and Emmitt, 2007; Morreale *et al.*, 2006). From critical review of extant literature, it can be opined that the available studies on communication performance measurement (see Liu, 2009; Xie, 2002; Xie *et al.*, 2000; Murray *et al.*, 2000; Mead 1999; Thomas *et al.*, 1998; CII, 1997; Hunter, 1993) in the construction industry have approached the subject in varing context. Even though it is admitted that, these studies have been very useful, it is still contended that, an improvement is still required in the construction industry especially on project of percuiliar attributes and thus provides a platform for further studies towards improvement (Liu, 2009; Hoezen *et al.*, 2008; Otter and Emmit, 2008; Gorse and Emmitt, 2007; Xie, 2002).

It is sternly opined that, before any effective communication performance measurement can be undertaken, there is the need to develop an objective and consistent measurable criteria (LeClair, 2010; Liu, 2009; Thomas *et al.*, 1998). Previous studies have classified these measurable criteria into performance factors and indicators (Xie *et al.*, 2010; Liu, 2009, Xie, 2002; Mead, 1999; Thomas *et al.*, 1998). This approach remains the most dominant and robust in communication performance measurement in the construction industry and thus conforms to the existing model approach by experts in management and Human Resource development on performance measurement (Keyton, 2011; Litman, 2009).

3.10.1 Approaches to and Focus of Communication Performance Assessment

According to Litman (2009) there are three general types and approach to performance measures. These are:

- Assessment of service outcome quality, which reflect the quality of service experienced by users;
- Indicators of measurable outcomes, which reflect the quality of the inputs; and
- Indicators of cost efficiency, which reflect the ratio of inputs (costs) to outputs (desired benefits).

From several studies on communication performance in the construction industry, the outcome indicator measure approach remains the dominant and widely used method (see Xie *et al.,* 2010; Liu, 2009; Xie, 2002; Murray, 2000; Mead, 1999; Thomas *et al.*, 1998; CII, 1997). This is because the approach offers a valid reflection of the measure of the impact of the factors on the communication performance outcome (CII, 1997; Thomas *et al.,* 1998; McCroskey and McCroskey, 1988). From the turn of 1997, the CII, (1997) has been the most robust indicators widely used in several studies for assessing communication performance outcome in the onstruction industry. The CII, (1997) developed a model that measures communication performance using nine distinct performance indicators. The measure of the indicators are reflected in the *'accuracy, timeliness, underloading, overloading, procedure, barriers, distortions, gatekeeping and understanding'* of the transmitted information (c.f Xie *et al.,* 2010; Liu, 2009; Xie, 2002; Xie *et al.*, 2000; Thomas *et al.*, 1998). Notable studies on communication performance measures among construction project team have been developed by limiting the measures to a selection from these nine indicators (see Liu, 2009; Xie, 2002; Murray, 2000; Mead, 1999; Thomas *et al.*, 1998).

3.10.2 Measuring Contruction Communication Performance

Even though several studies have explored Communication Performance measures in the construction industry, there seems to be a lack of consensus on the approach to measurement of construction communication performance in the construction industry. Thomas *et al.* (1998) and Xie (2002) affirmed that the single most significant step in the measurement of effective communication among project team lies in identification and measurement of critical communication variables that affect the performance outcome. This was further amplified in a study by Morreale (2009) that, in any communication context, the assessment of the effectiveness of communication is to investigate the factors that impact or determine how the goal of the communication process is achieved. To this end, it can be suggested that, measure of effective communication is conceived in terms of the valued performance outcome (Morreale, 2009). Against this, Liu (2009) opined that the factor indicator approach to CPM offers a critical method in assessing, evaluating and analysing the impact of any factors on the project team communication performance in a construction environment. Morreale *et al.* (2006), however revealed that, the effectiveness of communication performance exists on a continuum and thus conceived as quantitative indicators through a systematic evaluation of the inputs and outputs in a communication process. Hence this approach has been dominant in CPMs especially within the construction industry (see Xie *et al.,* 2010; Liu, 2009; Xie, 2002; Dawood *et al.,* 2000; Murray, 2000; Mead, 1999; Thomas *et al.*, 1998; CII, 1997).

3.11 COMMUNICATION PERFORMANCE INDICATORS

From literature, it can be affirmed that, the measure of the effectiveness of communication performance (flow of information and composition of information) among team members in the construction industry is measured by the accuracy, timeliness, completeness, understanding, procedures, distortions, barriers and gatekeeping indicators (Xie *et al.*, 2010; Liu, 2009; Xie, 2002; Murray, 2000; Xie *et al.*, 2000; Mead, 1999; Thomas *et al.*, 1998; CII, 1997; Guevara and Boyer, 1981; Higgin and Jessop, 1965). Against this background, to attempt to develop the indicators for this study, key studies were reviewed, contextualized and operationalized in the next section in order to identify its weakness and evolve a roboust communication performance indicators framework for the study.

3.11.1 Review of Higgin & Jessop (1965) and Guevara & Boyer (1981)

These are deemed as the pioneers in communication performance measurement in the construction industry. Higgin and Jessop (1965) studied the primal impact of the relationships between the communicators on the communication performance. The study provided the springboard for further intense and rigorous research into the communication task actions and performance in the construction industry. Findings from Higgin and Jessop (1965) study suggested that, the main challenege to the communication of information in the industry are related to underload, accuracy, timeliness, completeness understanding and barriers.

Guevara and Boyer (1981) focused on identifying problems with information flow in inter-personal communication in an organisation using four of the indicators as shown in Table 3.3 (page 102). Likewise, this study also paved way for further studies in communication performance measures. It can be noted that the findings were insightful and revealed distortion, gatekeeping, overload, and underload as the main indicators of communication problems.

3.11.2 Review of Knoop *et al.* (1996) and Hamilton *et al.* (1997)

Knoop *et al.* (1996) investigated communication performance among the design team by analyzing the impact of relationship among the design team. The study revealed accuracy, timeliness and completeness as the critical indicators for communication performance among the team by focusing on the design stage.

Hamilton *et al.* (1997) on the other hand studied the project team's communication performance on decision making among the design team at the design phase of the construction project. The study revealed that accuracy, completeness, understanding, barriers and timeliness of the communicated information as the main critical indicators of the communication performance on decision making at the design phase.

3.11.3 Review of CII (1997)

This study has received widespread attention and has been the foundation of studies by Liu, (2009), Xie, (2002), Murray, (2000), Mead, (1999) and Thomas *et al.*, (1998). The CII, (1997) expounded 9-indicators for accessing communication performance in the construction industry. These indicators relate to the accuracy, underloading, overloading (completeness), understanding, gatekeeping, timeliness, distortion, barriers and procedures of the communication on the construction project (CII, 1997). Mead (1999) explored the impact of intranet on the project team communication performance using six of the indicators from the CII study. In the work of Xie, 2002, the communication performance assessment was done using the 9-indicators by exploring impact on 'procurement method, communication system, client, contractors and key subcontractors (specialists), resource, social collaboration, technical collaboration and key personnel among the design team through a case study approach. The study revealed four main indicators as the major problems in information flow among the design team at the design phase. Murray, (2000), also used the CII, (1997) to explore the perception of communication effectiveness among the project team. In Liu, (2009), the effectiveness of communication performance was assessed by measuring the impact of management measures and project organizational complexities as the factors.

From the above findings, it is clear to note that, the CII, (1997) outcome measure has been the main driving indicators for assessing and evaluating project communication performance in emerging studies. The emergence and acceptance of the CII indicator approach is underpinned by the fact that the model incorporates communication variables from a humanistic viewpoint and social network for communication analysis which reflect the global construction project environment of social behavioural interactants.

Hence, in ensuring triangulation and theoretical validity, this study adopted the same approach from the studies above mainly being founded on a quantitative paradigm and research design. The summary of of the various indicators used in construction communication performance is presented in Table 3.3.

TABLE 3.3 SUMMARY OF LITERATURE ON COMMUNICATION PERFORMANCE INDICATORS

S/No.	COMMUNICATION PERFORMANCE INDICATORS (VARIABLES)	AUTHORS												
		Higgins & Jossep, 1965	Guevara & Boyer (1981)	CPI, 1987	Shen, (1992)	Wilkinson (1992)	Knoop et al., (1996)	Hamilton et al., (1997)	CII (1997)	Thomas et al., (1998)	Mead (1999)	Murray, (2000)	Xie, (2002)	Liu, (2009)
1	Accuracy	√		√	√	√	√	√	√	√	√	√	√	√
2	Barriers	√	√	√	√		√	√	√	√	√	√	√	
3	Overload		√		√				√				√	√
4	Under load	√	√		√				√		√	√	√	√
5	Timeliness	√		√	√	√		√	√	√	√	√	√	√
6	Understanding	√						√	√	√	√		√	√
7	Distortion		√			√			√				√	
8	Gate keeping		√						√				√	√
9	Procedures	√							√	√	√			

Source: Authors compilation from Literature

Drawing from the crux of this study, all the nine measuring indicators in Table 3.3 were adopted and conceptualized into a robust framework in Figure 3.7 below.

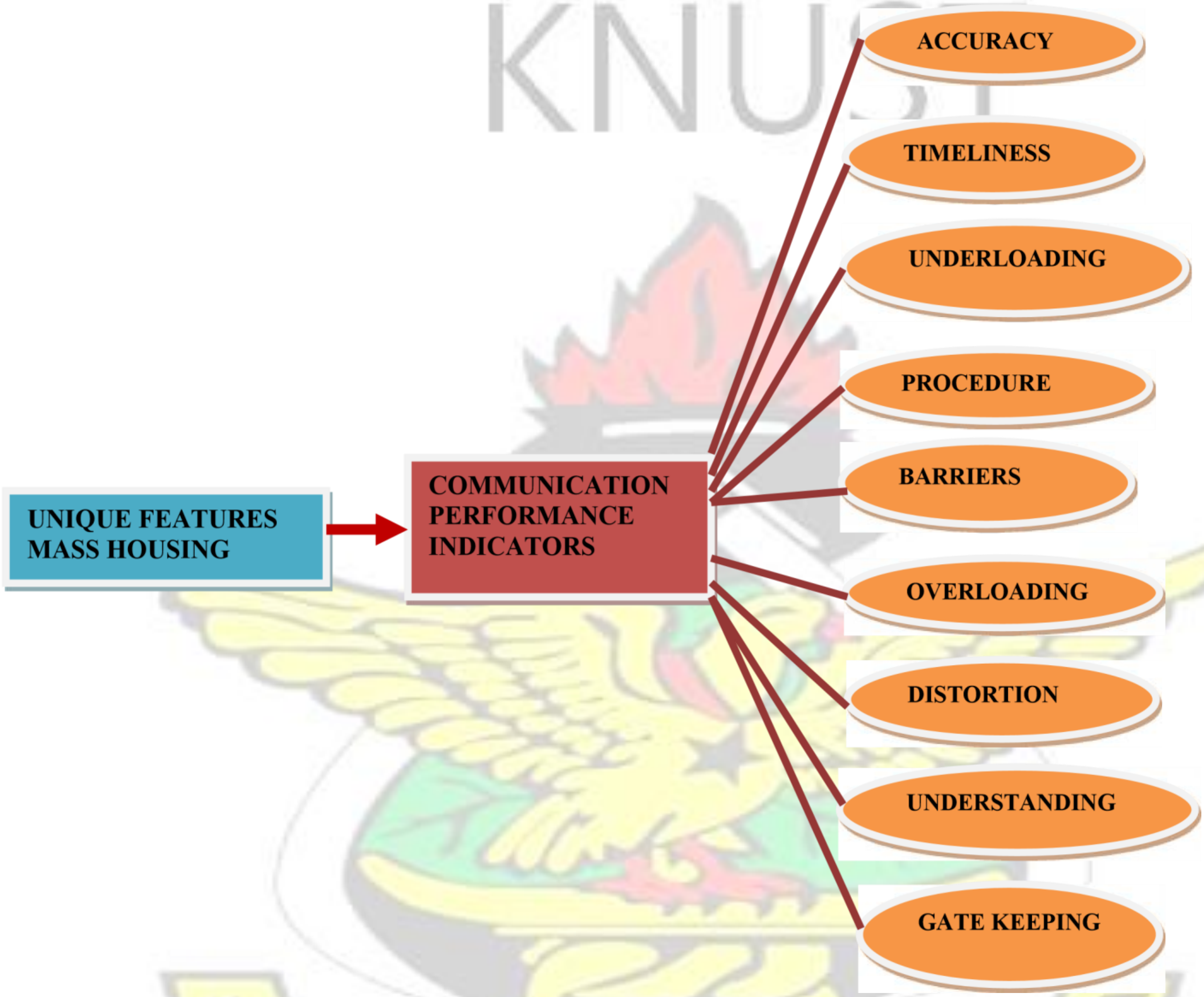

Figure 3.7: Robust Communication Performance Measures Framework, (Source: Author's Construct)

3.11.4 Understanding of the Communication Performance Indicators

From literature, it is clear that, the Key communication performance indicators (KPI) used in measuring communication effectiveness (see Table 3.3) has been accuracy, procedure, timeliness, distortion, barriers, completeness, overload, underload, understanding and gatekeeping. Adopting this for this study, it is very essential to present a precise meaning of these variables.

3.11.4.1 Accuracy

Information communicated is measured by its accuracy and preciseness to aid tasks being performed (Hunter, 1993). The accuracy of the information is measured by the frequency of poor decisions, conflicting instructions, poor coordination of tasks as a result of the received information and how information precisely reflect the intents (Xie *et al.*, 2010; Xie *et al.*, 2000; Mead, 1999). Against this, it is consequential that, in measuring effective communication performance, the project related information transmitted should be precise and accurate to aid mutual understanding towards minimizing conflicting instructions and aid coordination to successfully complete tasks.

3.11.4.2 Timeliness

The timeliness of communicated information refers to how early or late the project related information transmitted to the receiver is received for the intended purpose with an appropriate feedback. It is crucial that, for the prime and urgent use of project information communicated, parties have prompt delivery of the required information (Liu, 2009; Mead, 1999; Thomas *et al.*, 1998).

3.11.4.3 Completeness of Information

The completeness of the communicated information is a measure of the amount of relevant information received (Xie, 2002). That is, whether there are missing information or exactly as needed for use. In the CII (1997), the completeness of the communicated information is measured by the underoading and overloading of the information. It is always important that information shared in a communication process is right and complete (wholly relevant) without any amount of missing information to facilitate it use to perform the needed task (Lesko and Hollingsworth, 2011; Mead, 1999).

3.11.4.3.1 Underloading

Underload refers to a situation in which the information communicated to the receiver is not adequate for the intended task or usage (Xie, 2002; Mead, 1999). This situation immensely affects the communication performance in any context since not sufficient information is delivered for use.

3.11.4.3.2 Overloading

Communication overload on the other hand occurs when more than the needed information is communicated to the receiver leading to breakdown in the communication (Xie, 2002; Xie et al., 2000). This situation makes it difficult for the information to be used correctly. It is very important that in any communication context, not too much or not less information is received. As this continues to emerge as a major problem in construction projects in many developing countries and a major contributor to conflicts and unnecessary delays and eventually affects project performance ad productivity (ElSaboni *et al.*, 2008; Enshassi *et al.*, 2007).

3.11.4.4 Understanding

For communication to yield it intended goal, it is critical that the communicated information yields a mutual understanding to aid the use of the information. The understanding of communicated information received or expected from sender in assessing communication performance refers to how easily the information is mutually understood by the sender and receiver to promptly perform the task (Mead, 1999; Hunter, 1993). Understanding refers to the ease with which the communicated information is rightly interpreted to perform the intended tasks with ease (Liu, 2009; Xie, 2002).

3.11.4.5 Gatekeeping

This refers to the act of withholding information causing a delay in the release by a person tasked to do so (Liu, 2009). This person is often referred to as the gatekeeper who acts as an individual so located to control messages flowing through a communication channel (Mead, 1999; Xie, 2002). This situation happens either consciously or unconsciously and as such, a good gatekeeper should rather facilitate, smoothen and direct the flow of information through a channel (Liu, 2009; Xie, 2002).

3.11.4.6 Distortion

Distortion to the communicated information in a communication channel occurs when the meaning of the information is altered by changing the content (Murray *et al.,* 2000; Mead, 1999; Thomas *et al.,* 1998). It remains a major problem during information flow among project teams and the situation is prevalent in the construction project environment (Liu, 2009; Xie, 2002).

3.11.4.7 Barriers

Communicated information is likely to face a lot of barriers making access to the information by the intended recipients difficult if not almost impossible. Barriers thus refer to interpersonal, accessibility or logistic challenges inhibiting the prompt access to information communicated (Liu, 2009; Xie, 2002). Barriers to communicated information in the construction industry remain a common problem among project teams (Liu, 2009).

3.11.4.8 Procedure

This often refers to the communication protocols in the communication process. It is defined as the existence, use and effectiveness of formally defined protocols and procedures outlining scope, methods and communication strategy for sharing project related information (Xie, 2002; Mead, 1999). These are often contractually determined and are critical to the effectiveness of the communication performance (Otter, 2005).

3.11.5 Focus of Key CPMs

Researches on project team communication effectiveness and performance have evolved from assessing the tools used in communication (Emmit and Gorse, 2007; Mead, 1999), influence of relationships and organisational challenges to the communication, (Xie, 2002; Thomas *et al.*, 1998) to communication performance measures and evaluation (Liu, 2009; CII, 1997). There has also been studies focusing on the effectiveness of the communication medium on construction projects (Yuan and Kamara, 2008; Gorse and Emmitt, 2007; Otter, 2005; Brown, 2001; Hassan, 1996; Hill., 1995; Pietroforte, 1992) and identifying the communication problems among the team (Liu, 2009; Xie, 2002; Xie *et al.*, 2000; Thomas *et al.*, 1998). Others have also focused on identifying the communication behaviours among the project team (Otter and Emmitt, 2007).

It is suggested that team and managerial effectiveness can be enhanced by examining the impact of communication factors on specific project team communication performance such as among the project task consulting team, contractor and sub-contractors, consulting team and contractor and the behavioural actions of the participants (Liu, 2009; Hoezen *et al.*, 2008). According to Cantu (2007), some of the reasons for communication effective measurement in teams are based on the probability that the more effectively a team functions, the more benefits they are likely to realize from the work team structure. The summary of the focus of notable communication performance measures in the construction industry is presented in Table 3.4.

TABLE 3.4: SUMMARY OF FOCUS & GAPS IN LITERATURE ON COMMUNICATION PERFORMANCE MEASURES

Study Focus	References	Limitations
Communication relationship among Project teams	Higgin, and Jessop, (1965), Thomas et al., (1998), Bowen and Edwards (1996), Peng, (1994), Perry and Sanderson, (1998), Pietroforte, (1997), Popple and Towndrow, (1994), Roberto, (1997), Sonnenwald, (1996), Wong et al., (2004), Gorse, (2006), Murray et al., (2000), Minneman, S. (1991), Gorse and Emmitt, (2003)	Focused on the design phase of the project cycle. Not consider the construction stage Considered management strategies Does not consider the project typology and project environment (context
Communication Medium and Information Flow	Gorse and Emmitt, 2007, Austin et al., (1994), Brown, (2001), Hassan, (1996), Yuan and Kamara, (2008), Hill, (1995) Pietroforte, (1992)	Focuses on traditional 'one-off' projects Management and procurement systems
Identifying Communication Problems	Hunter, (1993) Thomas et al., (998), Guevara and Boyer's (1981), Eisenberg et al., (1985) , Dawood et al., (2002), Emmitt and Gorse, Mass (2003), Xie, (2000), Xie et al., (2010), Wikforss and Alexander, (2007), Liu, (2009), Ochieng and Price, (2010); Pietroforte, (1992)	Focuses on traditional 'one-off' projects. Yet to explore other project typologies (e.g. housing, Concurrent Engineering projects)
Communication Technology on construction projects	Mead, (1999) CII, (1997), Shen, (1992), Shohet and Frydman, (2003), Perry and Sanderson, (1998), Yang et al., (2007), Otter, (2005); Luiten and Tolman, (1997), Marshall-Ponting, and Aouad, (2005)	Does not deliver bespoke technology applicable to all projects typologies
Communication behaviours in construction communication	Gorse and Emmitt, (2007), Gorse, et al., (2000)	Focuses only on Project Leaders and Design Team

Source: Authors compilation from Literature

3.12 KNOWLEDGE GAP AND WAY FORWARD FOR PROJECT TEAM COMMUNICATION PERFORMANCE ASSESSMENT

Against the background of the presentation in *section 3.11.5,* this section has been structured to present a discussion on the emerging needs in construction project communication performance assessment in order to postulate the way forward in making improvement in CPMs. The studies by Ibrahim *et al.* (2011), Liu (2009), Yuan and Kamara (2008), Otter and Emmit (2007), Yang *et al.* (2007), Xie (2002), Murray (2000), Mead (1999), CII (1997) and Guevara and Boyer (1981), here in considered provided insightful lessons to critically identify the communication problems and measure its effectiveness by considering different factors and key performance indicators (KPIs). Their usage is significantly insufficient across all project typologies and for all the phases of the construction process considering the varying attributes of emerging projects. This is indeed further supported by the fact that, the communication challenges experienced among project teams may vary at the various construction phases, on various project typologies and under varying cultural and contextual influence. Also, these studies were undertaken in developed countries which practically and theoretically share varying cultural dynamics in project teams with sharp contrast in communication infrastructural backbone compared to developing countries.

Hunter (1993) contended that the study of communication performance and team effectiveness is an inexhaustible one and the construction industry is so diversified and fragmented that, a study on communication in the construction industry always leaves unexamined areas or sections requiring further review. Studies by Liu, (2009) and Xie (2002) considered project organizational complexities and managerial factors in their assessmet at the design stage and construction stage respectively. It can be seen that these studies focused on the traditional procurement system in China and Hong Kong respectively and on purely traditional 'one-off' construction building projects. However, it can be contended that, theoretically, project organizational complexities and managerial factors practically vary across various project typologies. Hence, given the varying complexities of emerging construction projects coupled with the unique attributes of some construction projects such as mass housing projects compared to traditional projects, there is a conspicuous limitation in the generalization and adoption of these studies across all project typologies. Again, a striking weakness of these models is that, their development and backing theories were pinned on the traditional management concept which theoretically differs significantly from the dominant project management concept in the global construction industry. Additionally, it can be emphasized that indeed, the project management concept in project delivery exhibit contrasting attributes and setting compared to other management approaches such as traditional procurement method, construction management and management contracting approach (PMI, 2008).

It is also suggested that, the focus on the human behavioural factors in the communication process is critical towards enhanced communication performance (Salleh, 2008; Otter and Emmitt, 2007; Adler *et al.*, 2004). However, to date Otter and Emmitt (2007) remain the notable study on the communication behavioural factors among construction project team. This study only focused on construction design team at the design phase. To this end, there is the general gap of lack of extensive studies on the behavioural communication factors on construction projects. Studies by Emmitt and Gorse (2003), Wong *et al.* (2004), emphasized that to improve communication performance, more attention should be given to the human behaviours impacting on communication performance outcome among the project team. To this, an effective assessment of CPMs towards improvement is to provide a critical evaluation of the communication skill and knowledge attributes of the communicators as the outcome measure approach critically depends on the inputs. It is however suggested that to help improve CPMs, it is essential to assess the human behavioural aspects of the communication actions. The main reason ascribed to this assertion is that communication process has a human dimension, that is people involved in it and thus a focus on improving the effectiveness can be linked to addressing their human factors and competencies (Henderson, 2008).

From review of extant literature and subsequent assessment of key CPMs (e.g Xie *et al.*, 2010; Liu, 2009; Azmy, 2009), there is the need to pursue further research on the subject as an effort to bridge the knowledge gap identified. Globally, there have been calls for improvement in communication performance among the project teams and the construction industry in general (Liu, 2009; Hoezen *et al.*, 2008; Dainty *et al.*, 2006; Xie, 2002), hence the following gaps are proposed as the way forward:

Communication Effectiveness to match Projects of Unique Features (e.g Mass Housing projects)

A very pertinent observation from various studies, frameworks and models on construction communication performance was in the limitation of their application across all project typologies especially projects of unique attributes such as mass housing projects. Ahadzie *et al.* (2014) Ibem *et al.* (2011) and Enshassi (1997) report of prevalent communication ineffectiveness which are inherent in the unique features and characteristics of mass housing projects compared to traditional construction projects commonly encountered in the industry. Against this, it is impereative, given the significance of communication effecetivness to consruction project delivery, for empirical studies to be pursued on mass housing project environment aimed at improving the communication performance.

Expanding Communication Performance Measures (CPMs) to embrace the Human Behavioural dimension of the communication process

Arguably, communication tasks on construction projects are performed by humans and not machines and technology. However, unlike in business management, social communication, psychology and educational sectors where communication behaviours (skills) have been pursued as a valid approach to identifying the key skills that engender effective communication outcome, same cannot be said about the construction industry. To date, Otter and Emmitt (2007) remain the notable study in such dimension. Nonetheless, even with that, they focused on design teams at the design stage of

construction projects on traditional 'one-off' projects. Against this, it is can be considered very significant for more studies to be pursued aimed at expanding CPMs to embrace the human behavioural dimension.

Exploring Communication Ineffectiveness in Project Management Concept & Environment

The project management concept (PMC) has been identified as a suitable paradigm towards enhanced project delivery results which is seen in its global acceptance over other forms of management approach (Omidvar *et al.*, 2011; PMI, 2008). It is further posited that, the project management approach to construction project delivery offer distinct challenges and knowledge. However, most established CPM models are purely based on other forms of management concepts which have different theoretical underpinning compared to the PMC. PMI (2008) indicated that, in project management practice, communication challenges, networks and linkages grow exponentially when the project team increases. Against this, communication measures must be expanded to include the cases, techniques, problems, media, technology etc on PMC project environment. This will be very essential in proposing veritable strategies that suit such project environment.

Focusing on communication problems, performance and communication failure on construction projects in developing countries.

Studies have affirmed that, cultural, social and economic dynamics of countries, region and places significantly impact on every aspect of construction project management and delivery (Christophe *et al.*, 2009; Ochieng and Price, 2010). Conversely, less attention has been paid to communication issues and performance on construction projects in developing countries which shares unique socio-cultural and economic characteristics that significantly impact on construction project delivery and team performance. Christophe *et al.* (2009) and Blodgett et al. (2008) empirically, proved that, the cultural and social dynamics of a team and country significantly impacts on the project management deployment in a country, team effectiveness and communication performance. Unfortunately, studies on such factors on communication performance in the construction industry in developing countries are lacking.

3.13 RESEARCH FOCUS OF THIS STUDY

It is said that, the effective approach towards communication improvement on construction projects is to identify the communication factors that impact on the communication performance outcome. However, this has not been expanded to projects of unique attributes such as mass housing projects. Communication ineffectiveness and loss of productive time continue to plague mass housing projects (Ahadzie *et al.*, 2014; Ibem *et al.*, 2011; Enshassi, 1997). Even though the mass housing sector stands to benefit immensely from the concept of communication effectiveness due to enhanced communication performance, rigorous studies are yet to be expounded on the type and nature of communication ineffectiveness inherent in their unique features and the MHP environment in general.

On construction projects in general, the contention is that communication among the project team must be unhindered and feedbacks should be given with absolute clarity to complete the communication process between the sender and receiver. Mass housing project team members should also additionally, generate new knowledge by collecting, sharing and transforming information about the project to be delivered, hence communication is necessary to facilitate these processes. Against this, given the unique contextual environment, it is crucial for the team to gain full understanding and knowledge on the empirical contribution of the unique attributes of MHPs to the communication performance outcome. This will undoubtedly, aid in adopting the most suitable medium and strategies to engender effective communication given the clear understanding of the communication implications of the unique attributes.

Hence, here in this study, the focus is to undertake an empirical assessment of the contribution of the unique features of MHPs to project team communication performance. The unique features of MHPs are denoted as the communication factors that will be perceived to influence the communication performance indicators in the measures. This will form the basis of developing an evaluative model that is suitable in assessing MHP communication effectiveness.

3.14 SUMMARY

The chapter has thoroughly expoused communication and communication performance in the construction industry and presented a strong basis to chart a new paradigm and focus in communication performance measurement approach as a major gap in existing literature. It has also revealed that, existing models are skewed towards traditional 'oneoff' project and traditional management concept focusing on the design phase. While agreeing that these studies are useful, the review has revealed areas for further rigorous studies to bridge the knowledge gap. The focus of this study is extending CPMs to projects of unique features (e.g mass housing projects) to bridge the knowledge gap.

CHAPTER FOUR

CHAPTER FOUR

4.0 DEVELOPMENT OF THEORETICAL AND CONCEPTUAL FRAMEWORK

4.1 CHAPTER OUTLINE

This chapter focuses on the development of a theoretical and conceptual framework within which the empirical investigation was undertaken. Under this chapter, the underlying theoretical framework for the study is rigorously discussed and presented with clarity. The main underlying philosophy and the theory behind the framework are also elucidated to present a strong foundation for the development of the research design. The theoretical framework based on the attribution theory of communication provides a link between the concepts and themes identified in the study.

4.2 THE THEORETICAL FRAMEWORK

The theoretical framework of a research study refers to the system of concepts, assumptions, expectations, beliefs, ideologies and theories that lend support and inform the research themes identified as well as their relationship (Creswell, 2009; Robson, 2002; Maxwell, 2004). It thus forms a critical part of any research design (Creswell, 2009; Maxwell, 2004). The theoretical framework for this study draws on the 'attribution theory' of communication performance as the main foundation for the study. Though, the

study relied on the attribution theory of communication performance, the theoretical framework also draws on '*Hofstede's cultural framework*' as widely applied to cultural dynamics in team function, work groups and organisation in communication, marketing and management (Mooij and Hofstede, 2010; Christophe *et al.*, 2009; Blodgett *et al.*, 2008). It also made use of the framework for communication performance indicators from CII (1997).

The attribution theory of communication was derived from main stream communication which involves intra-personal, inter-personal and organisational social interactions and behaviours as well as social psychology, while the framework for communication performance indicators was derived from construction project communication performance *(see sections 3.11)* in main stream project management practice in the construction industry. 'Attribution Theory', as applied to the communication process attempts to describe, explain and predict the influence of the communication factors on the communication outcome (Rasekh *et al.*, 2012; Baxter, 2008; Weiner, 2006). In this regard, the 'Attribution Theory' of communication outcome is in sink with the main research objective of identifying the key communication factors as the main attributions of effective communication performance on MHPs whereas the communication performance framework adopted lend support to the evaluative aspect of CPM of the impact of the communication factors on the communication outcome as presented in Figure 4.1 (page 121).

Additionally, the Attribution theory used draws on the multi-disciplinary nature of communication (social psychology, organisational and interpersonal interactions and behaviours, management, social communication etc) and thus evolving communication performance measures from a multi-disciplinary approach helps develop a robust conceptual model, towards addressing the key research questions and the main themes in the study. It is critical that dwelling on the fact that the study is positioned in the main stream project management practice in the construction industry, it is important to incorporate key elements of CPMs into the framework to make it more relevant to the industry and more specifically to mass housing projects. It is thus opined that the social and psychological dimension of this theoretical explication delineates the interactional aspect of the communication process in the construction process and the skills are depicted in the 'behaviour' of the communicator performing the task.

It has been postulated that communication is contextual, in that communication lies in the social human behavioural domain (Salleh, 2008; Morreale, 2009). Thus construction communication lies in the human behavioural domain and that the 'human behavioural communication competency skills' and the project context are the key attribution to communication performance outcome (Salleh, 2008; Manusov and Spitzberg, 2008; Henderson, 2008). Against this, Gao (2008) and Weiner (2006) posited that dwelling on the attribution theory, in communication performance assessment, the key behavioural communication skills (internal factors) and the context, challenges and environment (external factors) are the main 'locus of casualty' which determines the effectiveness or ineffectiveness of the communication performance outcome. Currently, the focus of general performance and improvement in mainstream management and project managetment practice is skill development and adapting to project characteristics and typologies (Remidez, and Jones, 2012; Henderson, 2008; Muller and Turner, 2007; Henderson, 2004; Adler *et al.*, 2004). This argument is advanced on the Skills Acquisition theory that skills are effective when developed suitable to specific task and context (Mirahmadi *et al.*, 2011; Sandhu *et al.*, 2008) and thus generic skills may not always be applicable to every context.

In furthering this, it is positioned that competency skills must be developed to suit the context, project typologies and particularities (IPMA, 2013; Dixon and O'Hara, 2008).

Against this, the inclusion of communication skills (human behavioural) dimension to the communication performance assessment model present a robust evaluative approach that allows for objective assessment and monitoring towards improvement through the acquisition of the requisite competencies to perform on MHPs. Hence, Project Managers (PMs) and Project Teams (PTs) who will be deemed competent and successful in project based organisations must effectively communicate by adapting skills that successfully convey project related information and messages in a way suitable to perform their functions and tasks (Liu, 2009; Sheryl, 2009; Murray *et al.*, 2000). Dwelling on this, Morreale (2009), Salleh (2008) and Dainty *et al.* (2006) suggested that, project teams must possess communication skills to perform both their task functions and be able to adapt their communication function to the project environment and context. They must also possess communication skills that promote good relationships and good social environment that successfully help to convey project related information and messages in an efficient manner suitable to perform their functions and tasks (Morreale, 2009; Salleh, 2008; Dainty *et al.*, 2006). In the next section the attribution theory which underpinnes the study is presented.

4.3 ATTRIBUTION THEORY OF COMMUNICATION PERFORMANCE

In the study of communication performance in the construction industry, there has been the recognition and widely used approach of predicting the influence of the communication factors on the communication performance outcome. Accordingly, several theories have been developed and a considerable body of empirical research has been carried out to test each theory. In the socio-dynamic contextual interactional aspect of communication, the attribution theory has emerged and been pioneered by several authors in the area of attributions of communication performance outcome (Rasekh *et al.*, 2012;

Lei and Qin, 2009; Hsieh and Schallert, 2008; Weiner, 2006; McCroskey and McCroskey, 1988).

In the field of communication, the use of the theory has been applied in the dimension of predictability and objectivity of the communication performance outcome by identifying the attribution factors to the performance outcome (Rasekh *et al.*, 2012; Lei and Qin, 2009; Hsieh and Schallert, 2008; McCroskey, and McCroskey, 1988). In their studies, they found significant relationship between the effort and abilities of the individual and the communication context (task difficulty, external environment) and their performance outcome. The theory contends that, the reason for the variation in communication performance outcome is attributed to the communication behaviours (skills) of the communication process and the context challenges. Hence, the 'attribution theory' posits that, the main attributions that determine the current and future contextual communication performance outcome are the internal and external factors in the communication context (Weiner, 2006; Hsieh and Schallert, 2008; Manusov and Spitzberg, 2008; Rasekh *et al.*, 2012). It further outlined that, communication performance measures lie in the 'causal locus' domain and that the measure of the effectiveness of the performance outcome will always be attributed to two main factors of internal and external attributes in the communication process (Rasekh, *et al.*, 2012; McIntosh, 2009; Manusov and Spitzberg, 2008; Weiner, 2006; Manusov and Harvey, 2001).

The theory again maintains that the perception of an individual's success or failure in any communication task performance is attributed to the ability and effort (internal factors) of the individual performing the task and the context environment (external factors) (Rasekh, *et al.*, 2012; Manusov and Spitzberg, 2008; Weiner, 2006; Manusov and Harvey, 2001). The theory is widely used in the fields of languages, anthropology, psychology, education, law and mainstream communication (see Peacock, 2010; Baxter, 2008; Ong, 2006; Boruchovitch, 2004; Dornyei and Murphey, 2003). In making attributions, the primal motive and purpose is to achieve 'cognitive control' through explaining and understanding the causes behind behaviours, context and performance outcomes (Baxter, 2008; Salleh, 2008; Ong, 2006). It is said also that, attribution making gives order and predictability to process, action and the outcome (Weiner, 2006).

In light of this, it is said that, the communication performance outcome in a communication process will depend on the main external and internal factors. The attribution of the internal and external factors on the communication performance outcome is conceptualized in the Figure 4.1:

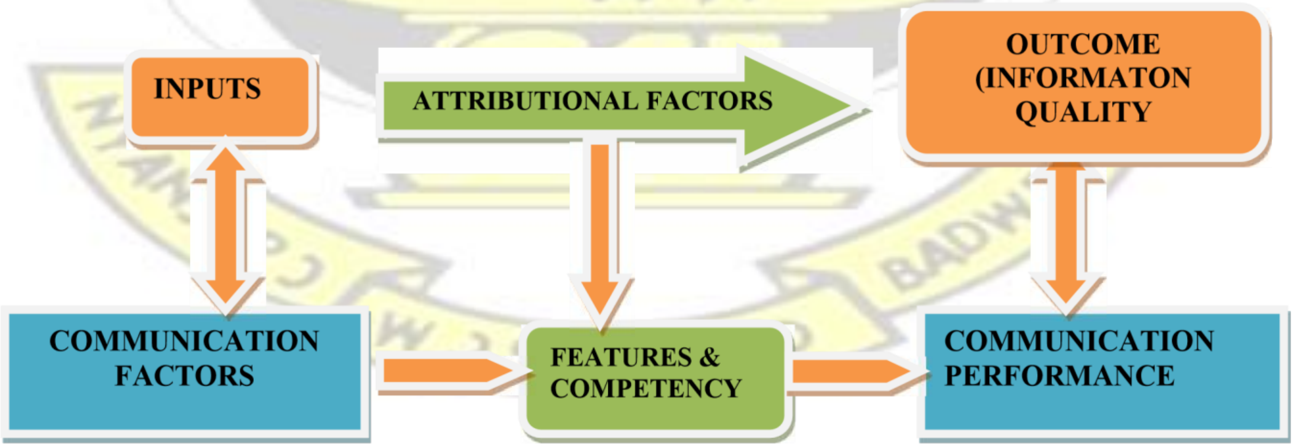

Figure 4.1: Representation of the Attribution Theory for communication performance

The internal factors relate to the behavioural communication competencies of the communicators whereas the external factors relate to the influence of the communication environment, task difficulty and the communication context (Rasekh *et al.,* 2012; Manusov and Spitzberg, 2008). Against this, in measuring communication performance, it is asserted that the causal behavioural attributional factors and the external contextual environment factors must be identified (Rasekh *et al,* 2012; Weiner, 2006). Again, Liu, (2009) and Xie, (2002) also lend support in their studies that, to critically assess and measure effective communication performance in the construction industry, the central focus should be on the communication factors of the communication process. By drawing on the theoretical and practical perspectives of communication in the construction industry, it can be asserted that both the project context (here denoted as the features of the project) and behavioural communication skills remain the main attribution factors that greatly influence the effectiveness and appropriateness of communication performance outcome.

Here in this study, the attributes of mass housing projects inherent in its physical, organizational and operational features are denoted as the external causal factors that significantly influence the communication outcome among the mass housing project teams (Kwofie *et al.,* 2014; Enshassi, 1997). The internal factors related to the communication competency (skills) of the communication task performers in the communication process. Monrale (2012), Burleson (2008), Edgar and Lockwood (2008) and Salleh (2008) defined the communication behavioural skills as the 'functional task skills' and 'innate communication skills'. The functional task skills or behaviours are the

skills needed to perform their communication task on their technical task in any given communication context whereas the innate skills refers to the psycho-social communication skills (Keyton *et al.*, 2013; Reeta and Neerja, 2012; Salleh, 2008; Henderson, 2004). The 'innate skills' or rhetorical competency (psyco-social communication skills) emphasize that, construction communication lies in the social behavioural domain and that the communicators must possess these skills to maintain the social, psychological and organisational cohesion for the successful implementation of the key technical task function (Morale, 2009; Salleh, 2008; Burleson, 2008).

Given that construction project environment is said to be collaborative, interdependent, multi-disciplinary and adversarial (Orgen *et al.*, 2012; Liu, 2009; Baiden *et al.*, 2006; Xie, 2002), the 'innate skills' or rhetorical competence are very crucial in maintaining the relationship, organisational psychology and the social cohesion for successful task performance. This was supported by the '*Hofstede's cultural framework'* which indicates that cultural dynamics in teams, work groups and organisation have valid influence on task function when considered as a collective group than individuals (Mooij and Hofstede, 2010; Christophe *et al.*, 2009; Blodgett et al., 2008). In a typical communication process, communication involves senders encoding information to receivers to decode and send feedbacks (Emmitt and Gorse, 2007; Dainty *et al.*, 2006; Otter and Gorse, 2003). Against this project related information e.g. drawings and BOG must be encoded and sent to be decoded by receivers with understanding to perform the task related to this information. This skill was expanded in a study by Henderson, (2008 & 2004) to include encoding skills and decoding skills related to the sending and receiving of required functional task information. Against this, the two main communication behavioural skills were operationalized as encoding functional task skills, decoding functional task skills, encoding psyco-social communication skills and decoding psyco-social communication skills.

Given that the current study is focused on the quality of the information flow and information composition outcome inherent in the influence of the unique mass housing features, CII (1997) was adopted as the communication performance outcome indicators. The justification is explained in *section 3.11*. Hence from this, the main concepts identified in the communication performace attributions are: the internal factors (behavioural communication skills), external factors (unique features of mass housing projects) and the communication performance indicators. The external and internal factors are noted as the communication factors that influence the communication performance outcome.

4.4 CHARACTERISTICS OF COMMUNICATION PERFORMANCE ASSESSMENT

The theoretical underpinnings of communication performance in the construction project environment lies in the fields of interpersonal, organizational communication and behavioural domain (Henderson, 2008 & 2004; Jablin and Sias, 2001; Spitzberg, 2000). Communication performance being perceived as measureable means it has unique identifiable, significant and has a quantitative depth that is of distinguished importance (Liu, 2009; Henderson, 2008; Dainty *et al.*, 2006). It can also be said that, CPM has an evaluative property that lies in the possibility to continuously access and identify desired levels of key outcome indicators (variables) that reflect the results of the communication action (Spitzberg and Chagnon, 2009; Morreale *et al.*, 2006; Monge *et al.*, 1998; McCroskey and McCroskey, 1988). Against this, it is posited that, the variation in the measure of communication performance from the communication task action will lie in the effects of the main attributions of the communication task outcome (Morreale, 2009; Salleh, 2008; Morreale *et al.*, 2006; Monge *et al.*, 1998 & 1987). It is also said that, in the measure of communication performance outcome, there is interplay of multiple distinguishing variables such as communication factors and communication performance indicators sharing complex correlations in the communication performance assessment (Keyton *et al.*, 2013; Henderson, 2008 & 2004).

Likewsie the measure of the impact of the perceived communication factors on communication performance can be determinate (Limpornpugdee *et al.*, 2009) as seen in the works of Xie, (2002) and Liu, (2009). Hence by drawing on the crux of this study, it can be contended that the measure of the impact of the unique attributes of MHPs (project factors) on the communication performance can be determinate but through an evaluative, objective and predictive approach. Also, it is important for the measure to reflect a more robust assessment approach towards prognosis and improvement hence the inclusion of the human behavioural factors is crucial. This is underpinned by the fact that construction communication and general communication is contextual and lies in the social human behavioural domain (Salleh, 2008; Spitzberg, 2002; Jablin and Sias, 2001).

To this end, it can be postulated that the expansion of communication performance assessment to include the human behavioural aspects presents a more robust and valid evaluative, objective and predictive approach. By drawing on current trends in communication performance assessments, it is asserted that the approach should be conceptualised and operationalized based on the communication factors, communication behaviours and the communication performance outcomes (Kwofie et al., 2014; Liu, 2009).

This approach allows for continuous evaluation and assessment of the influence of the factors and behaviours on the outcome and thus this nature lends support for adapting the framework by Ahadzie (2007). In this study, the unique features of MHPs and the behavioural skills were identified and considered as the main communication factors that influence the communication performance outcome indicators and this can be operationalized in an iterative evaluation. Drawing on this and the focus of this study, a simple framework was developed in Figure 4.2 for the key concepts identified in the communication performance and communication factors as an abstraction indicating the key characteristics for CPMs on MHPs.

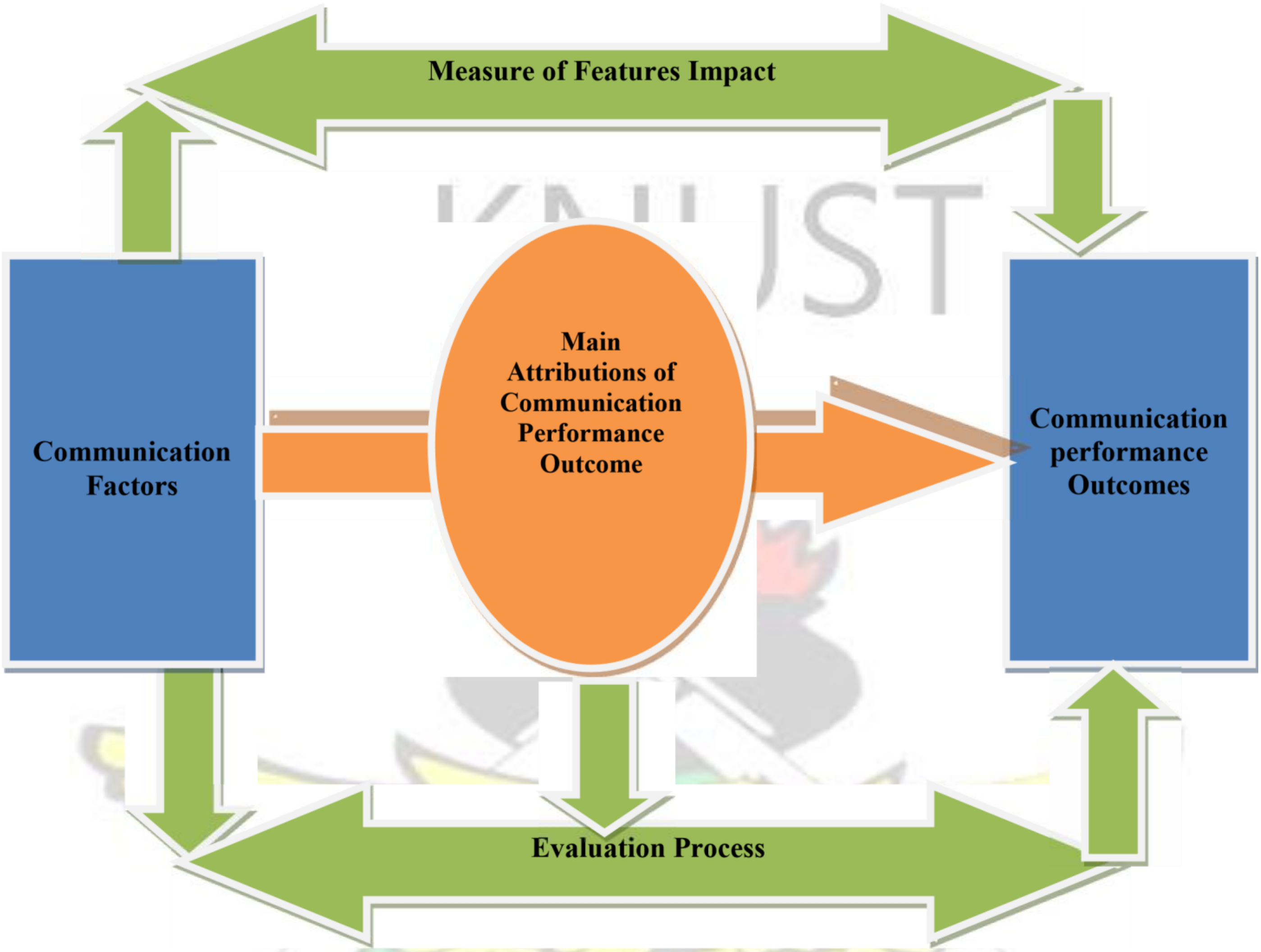

Figure 4.2: Framework capturing key concepts of communication performance measures on Mass Housing projects. After Ahadzie, (2007)

In the next section the conceptual framework developed to capture the key concepts and themes in the study is presented in the next section.

4.5 CONCEPTUAL FRAMEWORK FOR EVALUATING PROJECT TEAM COMMUNICATION PERFORMANCE ON MASS HOUSING PROJECTS

A conceptual framework is conceived as a visual or written product (graphical or narrative form) that seeks to capture and explain thoroughly, the main factors, concepts and variables in a study (Sinclair, 2007; Ennis, 1999).It also depict and explain the inherent relationship amongst the key concepts and variables identified and also offer a clear process of achieving them (Sinclair, 2007; Ennis, 1999). From the understanding gained in the attributions of communication performance outcome presented in the last section, it can be affirmed that communication performance models offer a good understanding of the relationship between the main communication factors that affect and influence the performance outcomes (Liu, 2009; Marshall-Pointing and Aouad, 2005; Xie, 2002). It also offers an evaluative, objective and predictive approach for constant monitoring of the actions (inputs) against performance outcome for improvement (Xie *et al.*, 2010; Liu, 2009; Marshall-Pointing and Aoud, 2005; Xie, 2002).

In the context of this study, it is thus considered important to aid a clear and precise understanding of the relationship between the main attribution factors (*'unique features'* of MHPs and the *'behavioural skills'*) and their extent of impact on the communication performance among the project team. Hence, a conceptual model which rigorously integrates these key concepts identified is thus useful for objective evaluation and predictive purposes. Construction projects and Mass Housing projects (MHPs) are said to possess unique features which are expressed in the *'physical, organisational and operational'* attributes (Ahadzie *et al.*, 2014; Adinyira *et al.*, 2013; Zauril and Rahinah, 2011; Manu, *et al.*, 2010; Enshassi, 1997). It is further asserted that project teams can communicate effectively and enhance their performance outcome by possessing *'functional task skills'* in encoding and decoding as well as *'psycho-social'* communication skills (Morreale, 2009; Henderson, 2008 & 2004; Salleh, 2008). These skills and the unique attributes of MHPs are the critical *'causal locus'* that determines the communication outcome (Burleson, 2007; Weiner, 2006). Alternatively, the result of communication outcome in any context is dependent on the competency input and the contextual environment in the communication process (Hsieh and Schallert, 2008; Burleson, 2007; Weiner, 2006).

Building on this background and the exposition given above, the extent to which the external and internal attributional factors impact on communication performance among the project team can be illustrated and operationalized in the model shown in Figure 4.3. However, in this study, the focus of measures was on the external attributional factors that influence the communication performance outcome. The focus on the external factors was entirely influenced by the lack of rigorous empirical studies on the nature and extend of the contribution of the attributes of MHPs on communication performance that has widely been acknowledged in literature (see Ahadzie *et al.*, 2014; Zauril and Rahinah, 2011; Ibem *et al.*, 2011; Enshassi, 1997). Also, it was to build on existing studies on communication performance measures that have focused on other external factors (see Xie *et al.*, 2010; Liu, 2009; Xie, 2002; Mead, 1999; Thomas et al., 1998). Hence the main instrument developed for eliciting the empirical data for the study focused on the unique features of MHPs. Hence the key variables contained in the model for the measures are operationalized in Table 4.1.

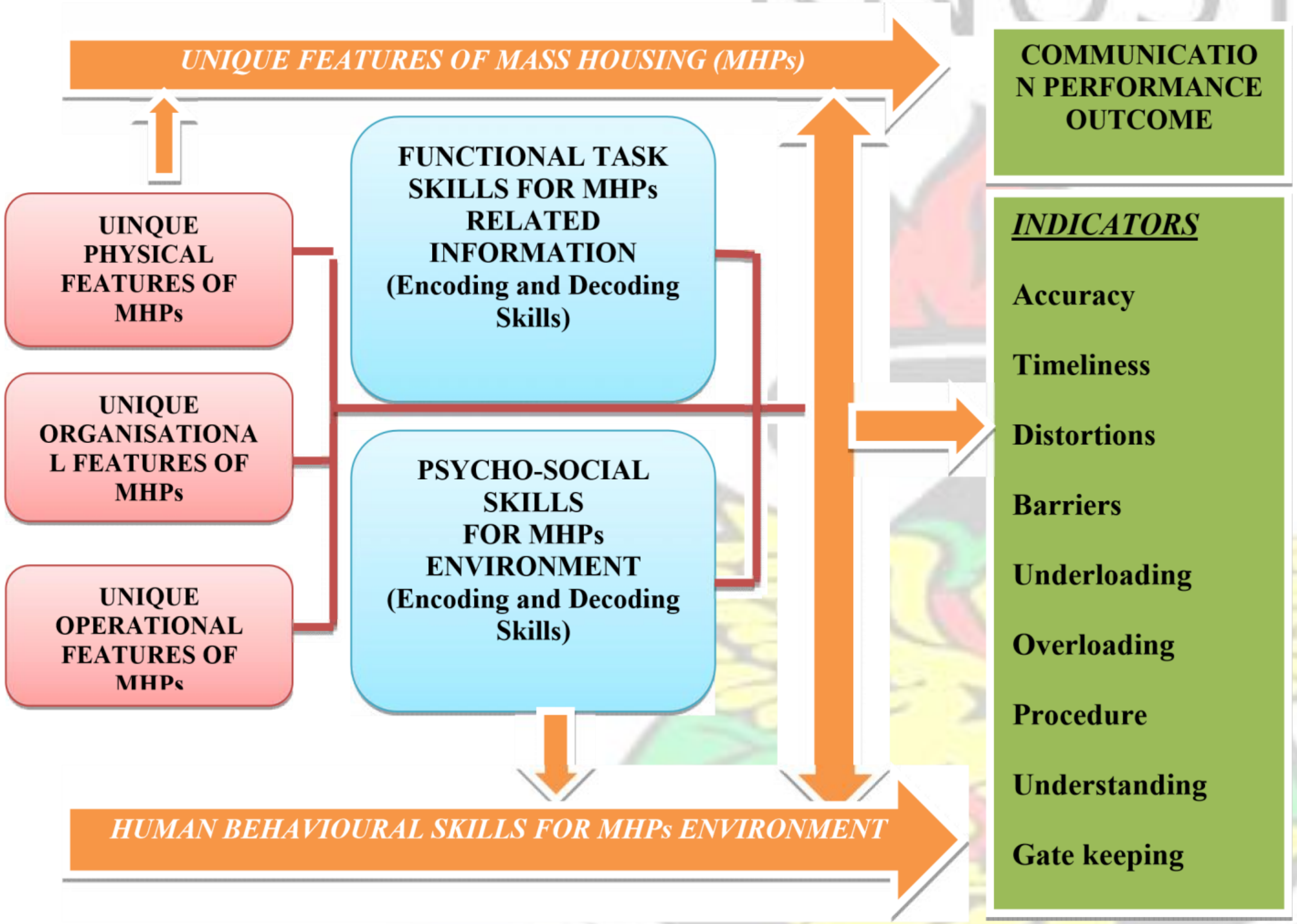

Figure 4.3: Conceptual Model Capturing the Communication factors (Unique Features and Behavioural Competency) on Project Team Communication Performance on MHPs

Table 4.1: Latent Construct Measures (Dependent and Independent Variables) of the Abridged Conceptual Model for the Research Instrument

Dependent Variables (Communication Performance Indicators)	Independent Variables (Communication Factors)- Unique Features of Mass Housing Projects
Accuracy: ○ Receiving conflicting information from team participants. ○ Lack of consistency in communicated information leading to lack of coordination among project team. ○ Lack of conciseness in communicated information among the project team. ***Timeliness:*** ○ Late delivery of needed communicated information ***Underloading:*** ○ Receiving less information than expected from team participants for tasks ***Overloading:*** ○ Receiving more information than necessary for the tasks ***Understanding:*** ○ Misunderstanding of communicated information ***Barriers:*** ○ Difficulty in accessing communicated information from channels	***Multiple Construction Sites Management Style (MCS) Features*** MCS1 Contractor management style adopted on housing units under scheme MCS2 Site management style adopted on the housing units under scheme MCS3 Construction technology and method adopted for repetitive works in housing units under scheme MCS4 Change orders (Variation Orders) procedures adopted on repetitive housing units under scheme MCS5 Health and safety management techniques adopted for repetitive task construction works on housing units under scheme MCS6 Computer application software(s) adopted by project teams on housing units under scheme MCS7 Quality Management style and approach adopted on housing units and overall scheme(s) ***Housing Unit Design Contract Packaging (HDP) Features*** HDP1 Composition of housing design in each contract package under housing scheme HDP2 Construction elements and components adopted in design units in contract packages under scheme

HDP3 Packaging of 'one-off' infrastructure. e.g water, electricity, road etc on housing units under scheme

Table 4.1 Cont'd

Dependent Variables (Communication Performance Indicators)	Independent Variables (Communication Factors)- Unique Features of Mass Housing Projects

Distortion: ○ Persistent change in meaning of communicated information. ○ Persistent change in content of communicated information.

- ○ Lack of clarity in communicated information resulting in different interpretations.
- ○ Lack of coherency in communicated information resulting in different interpretations

Gate-keeping:-

- ○ Witholding of part of the information by the one who controls communication
- ○ Witholding of whole of the information by the one who controls communication

Procedures:-

- ○ Lack of defined roles and responsibilities among members of the team leading to communication failure ○ Difficulty in disseminating information among project team HDP4

Contractual arrangement on 'one-off' infrastructure. e.g water, electricity, road etc on housing units under scheme

HDP5 Packaging of 'Preliminaries items' adopted under standardised repetitive housing units under scheme

HDP6 Contract Type adopted for Preliminary items

Multiple Geographical Location for Various Schemes (MGL) Features

MGL1 Influence of Local Development Controls across different geographical locations on housing units under scheme

MGL2 Cultural influence within labour work force due to geographical locations

MGL3 Influence of customary laws and practices on the tennural lands under scheme in various geographical locations

MGL4 Geographical constraints and challenges due to location influence on repetitive works and housing delivery

 Complex Network of Procurement Systems (NPS) Features

NPS1 Labour contracting style on housing units under scheme

NPS2 Project team composition adopted on the housing scheme under management (eg. only in-house team or in-house and external professionals (mixed)

NPS3 Construction material procurement style adopted on the housing scheme NPS4 Subcontracting style adopted across housing units under scheme

NPS5 Control, monitoring and coordination style in subcontracting on housing units under housing scheme

Table 4.1 Cont'd

Dependent Variables (Communication Performance Indicators)	Independent Variables (Communication Factors)- Unique Features of Mass Housing Projects
	NPS6 Prospective Buyer' involvement in the construction process under scheme
	Repetitive Tasks Management Delivery Strategy (RDS) Features
	RDS1 Labour management techniques adopted for standardised repetitive construction works on schemes
	RDS2 Cost saving management techniques adopted for standardised repetitive construction works on housing units under scheme
	RDS3 Project delivery times adopted for various housing units under the scheme
	RDS4 Repetitive Task delivery scheduling concept adopted on various housing units
	RDS5 Contractual relationship adopted among project team
	RDS6 Reporting styles adopted for Project Team (PT) communication
	RDS7 Dissemination protocols adopted for Project Team (PT) communication
	RDS8 Information documentation style adopted among team on housing units under scheme(s)

4.6 STRUCTURAL COMPONENT OF THE CONCEPTUAL MODEL

The main hypothesis underlining the conceptual model for this study is that mass housing project team communication performance outcome (PTCPE) at the construction stage is influenced by the unique features of MHPs expressed in Multiple Construction Sites Management Style (MCS), Housing Unit Design Contract Packaging (HDP), Multiple Geographical Location for Various Schemes (MGL), Complex Network of Procurement System (NPS) and Repetitive Tasks Management Delivery Strategy (RDS). In this study, it is well postulated that project team CPM is an evaluation and reflection of the skills input and influence of the project environment (MHP features) (see Liu, 2009; Dainty et al., 2006; Xie, 2002; Murray *et al.*, 2000; Mead, 1999; CII, 1997).

From the operationalized abridged conceptual model developed from the main conceptual framework (see Figure 4.4), the communication performance outcome experienced among the project team is denoted as an objective evaluation of the influence of the unique attributes of the housing projects and environments defined in the variables. Here, the communication performance indicators were treated as the criterion (dependent) variable whereas the external factors (unique features of mass housing projects) were thus treated as the predictor variables (see Table 4.1).

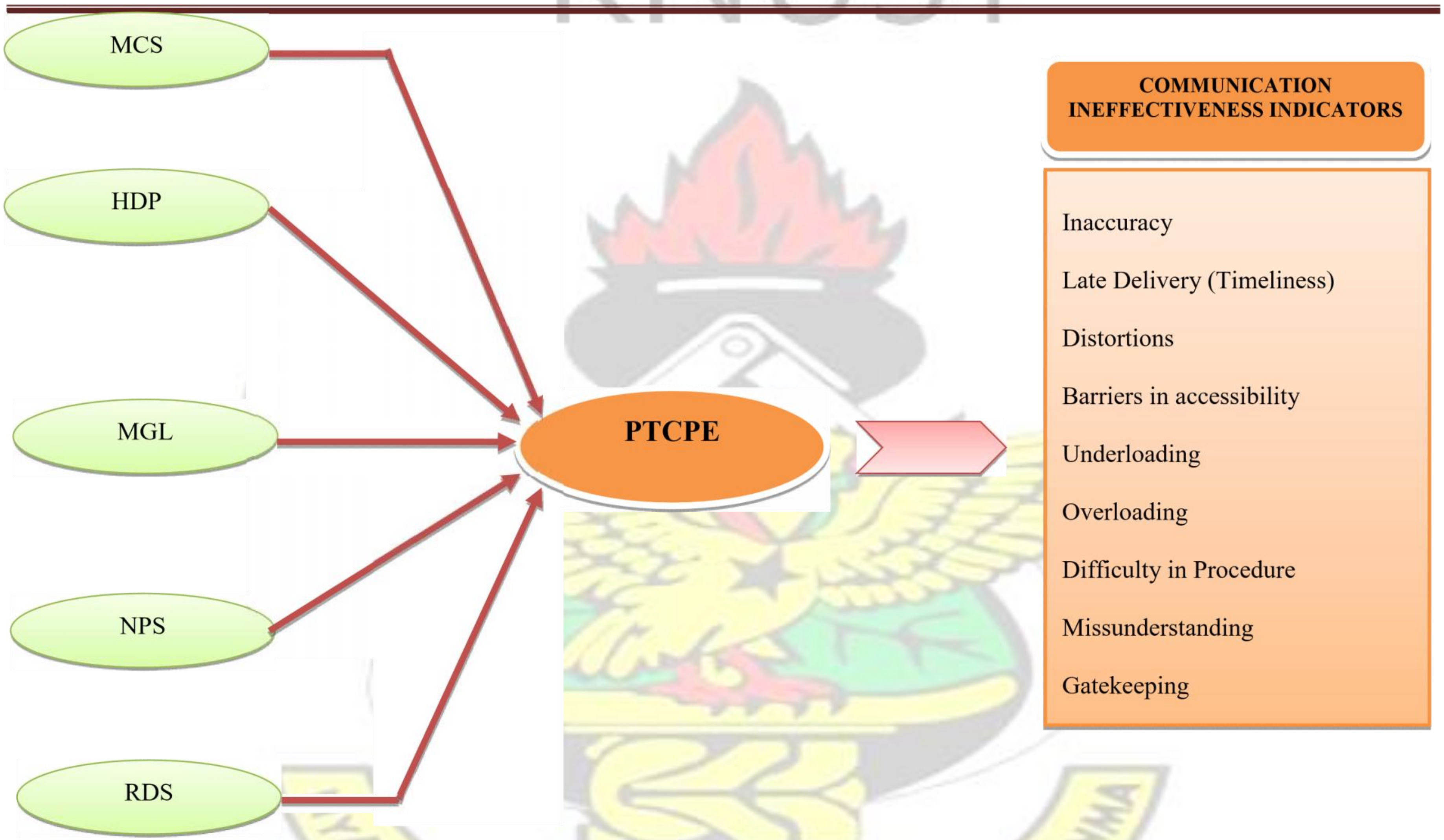
MCS
HDP
MGL
NPS
RDS
PTCPE
COMMUNICATION INEFFECTIVENESS INDICATORS
Inaccuracy
Late Delivery (Timeliness)
Distortions
Barriers in accessibility
Underloading
Overloading
Difficulty in Procedure
Missunderstanding
Gatekeeping

Figure 4.4: An Abridged Integrated Conceptual Model of Mass Housing Project Team Communication Performance Outcome

4.7 SUMMARY

In this chapter, the main concepts, the theory and conceptual model underpinning the study has been elucidated. The abridged conceptual model postulated that Mass Housing Project Team Communication Performance Effectiveness is a multidimensional structure composed of six latent construct variables comprising of Multiple Construction Sites Management Style (MCS), Housing Unit Design Contract Packaging (HDP), Multiple Geographical Location for Various Schemes (MGL), Complex Network of Procurement Systems (NPS) and Repetitive Tasks Management Delivery Strategy (RDS). The theoretical framework and the construct variables of the unique attributes of MHPs are also presented. The next chapter focuses on the selection and development of appropriate methodology that suitably synthesizes the main aim of the study.

CHAPTER FIVE

CHAPTER FIVE

5.0 RESEARCH DESIGN AND METHODOLOGY

5.1 CHAPTER OUTLINE

The use of appropriate research design and methodology helps researchers to minimize the complexity of the study, as well as present a logical procedure to addressing the research objectives and questions (Marczyk *et al.,* 2005). This chapter thus discusses the research methodology and the strategy adopted for the study. It entails a presentation of the overall research design, the systemic rules and procedures upon which this research agenda is based as well as the sequence, flow and interrelationship of all activities involved in the research to answer the research questions. The philosophical paradigm adopted, approach, methodology, design process, sample frame, the data collection instrument and the accurate interpretation of the data are justified in the following sections.

5.2 RESEARCH PROCESS

The main focus of this study is to investigate the contribution of the 'unique features' of mass housing to communication performance among the project team (see section 1.4). The research process adopted for this study involved an extensive review of literature on the subject area through to the identification of the main concepts, development of the theoretical framework, conceptual model and the collection of empirical data to meet the research agenda. From the review of literature to a preliminary study and pretesting of the instrument, two main factors were identified for the communication performance assessment as project related factors (external factors) ie. 'unique features of mass housing' and 'human behavioural factors' (internal factors) as presented in chapters 2 and 3 respectively.

A preliminary survey established the unique features of mass housing projects serving as the project related factors (external factors). From literature, the CII (1997) was adopted as the key communication performance indicators (see section 3.11.4). Additionally, by drawing on the presentation in chapter 4, the relevant theory and theoretical background to stimulate and drive the study was provided. This also provided a solid foundation for deciding on the philosophical consideration necessary for the research design and strategy as indicated in section 4.3. The determination of the suitable research design and strategy provided a solid and rigorous foundation to address the research aim and meet the study objectives (see section 1.6).

The final stage of the study focused on the collection of appropriate data through questionnaire survey for the development of the evaluative communication performance model to meet objectives three (3) and four (4). Figure 5.1 represents a summary of the research process.

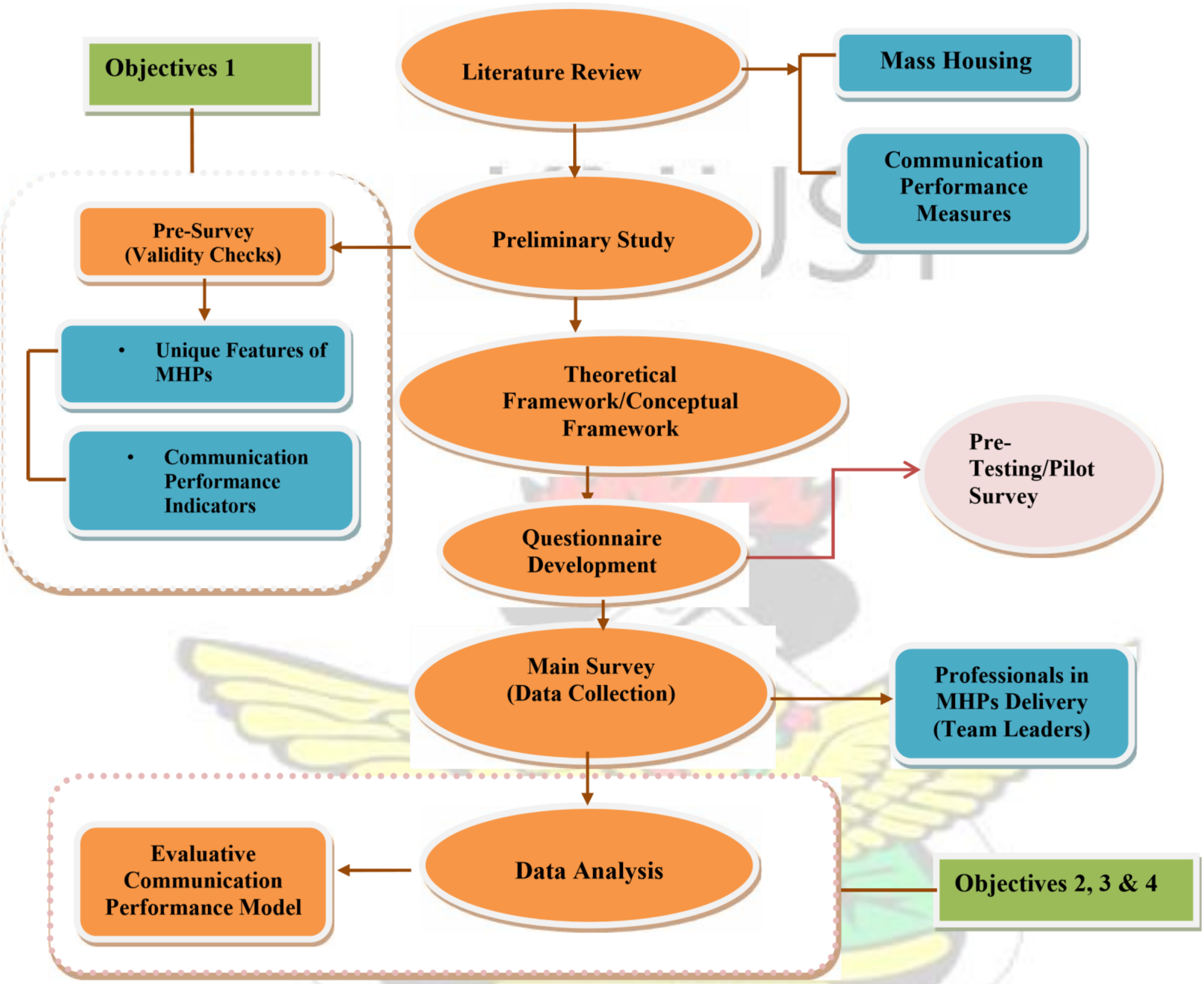

Figure 5.1: The Research Process, Source: Authors own design

5.3 PHILOSOPHICAL CONSIDERATIONS

According to Creswell, (2009), there are several considerations that underpin the philosophical position of any research. Bryman (2009) outlined the ontological, axiological and epistemological considerations as the three main concepts that underpin and explain the philosophical position of any research. It is thus asserted that, to successfully choose a suitable philosophy for any study, the main concepts must be identified, thoroughly explained and understood (Cresswell, 2009). The philosophical paradigm adopted in any study is thus crucial in the choice of an appropriate research methodology (Creswell, 2009; Easterby-Smith et al., 2003). Against this, in order to adopt the suitable philosophical position for the study, the epistemological, ontological and axiological assumptions were critically and thoroughly considered.

5.3.1 Epistemological Considerations

The epistemological consideration underpinning the philosophical position of a research study deals with issues relating to the level of acceptability of knowledge in any discipline (Vanderstoep and Johnston, 2009; Cresswell, 2009). It also derives the causal relationship between the researcher and the subject under consideration (Cresswell, 2009). Bryman (2009) and Cresswell, (2009) identified positivism and intrepetivism as the two main epistemological consideration especially in social science and construction management researches.

The positivist epistemological position opines that, natural science methods can be applied to the study of social phenomenon (Cresswell, 2009; Bryman, 2009). It also holds the belief that, the world conforms to fixed laws of causes and effects, as such complex issues can be tackled through the use of simplified mathematical or fundamental approach (Bryman, 2009; Cresswell, 2009). Likewise, this position asserts that, research problems and questions can be solved through a process of objective measurement and repeatability approach where the researcher remains neutral and detached from the process (Bryman

2009; Saunders *et al.*, 2009). Additionally, the positivist position holds an assumption that, knowledge is generated through observable facts, phenomenon and measured through objective methods (Creswell, 2009; Saunders *et al.*, 2009).

The interpretivist epistemological position on the other hand asserts that, the research context and phenomenon does not follow any universal truth but rather are subject to the understanding and interpretations from the researcher's perspective and point of reference (Cresswell, 2009; Saunders *et al.*, 2009; Marczyk *et al.*, 2005). Likewise, in interpretivism, the researcher shows a strong biased commitment to the study and interpretations; he/she is also fully immersed in the study, and that the values and beliefs of the researcher become the driving force in the interpretations of the research findings (Bryman 2009; Vanderstoep and Johnston, 2009; Marczyk *et al.*, 2005).

From the nature of research questions and objectives of the study, it can be affirmed that, this research seeks to investigate the causal relationship between variables (contribution of unique features of MHPs on communication performance) under consideration. This attribute of the study clearly typify that, the positivism epismological position which seeks explore causes and effects through the use of simplified mathematical or fundamental approach would prevail as the more suitable and hence was adopted.

5.3.2 Ontological Considerations

The ontological assumption of any research concerns the nature of reality or idealism that influences the research phenomenon (Cresswell, 2009; Vanderstoep and Johnston, 2009). The ontological consideration views the research phenomenon from realist or idealist perspective (Cresswell, 2009). The realists view the research reality with a thorough predetermined structure whereas the idealists posit that, the research reality is based on different perceptions from different observers (Cresswell, 2009; Vanderstoep and Johnston, 2009). The realist view leans towards the positivist philosophy whereas the idealist lies in the interpretivist domain (Cresswell, 2009; Bryman, 2009).

From this perspective, it can be suggested that, a study of the relationship among determined and definite variables (pre-determined structure) exhibits the characteristics of realist view (Bryman, 2009; Pathirage *et al.*, 2005). Also, the realist view is in congruence with the positivist paradigm. Hence, here in this study the realist perspective was adopted.

5.3.3 Axiological Considerations

The axiological position of any research considers whether the research phenomenon is either "value free" or "value laden" (Creswell, 2009; Marczyk *et al.*, 2005). According to Creswell, (2009), a research study is 'value free' when the phenomenon can be subjected to an evaluative objective criteria whereas in 'value ladden', the study is driven by subjective criteria. It is said that, the 'value free' position is embedded in the positivism paradigm whereas the 'value laden' phenomenon leans towards the interpretivism paradigm (Cresswell, 2009; Bryman, 2009; Vanderstoep and Johnston, 2009).

Pathirage et al. (2005) revealed that, a study that investigates the causal relationship between pre-determined structures in variables often adopts objective criteria in its approach and this is mostly positioned in the 'value free' axiological perspective.

Similarly, such a position is always in congruence with the positivist epistemological and realist ontological positions (Pathirage et al., 2005) as typified in Figure 5.2. Hence, these arguments support the choice of the value-free axiological perspective and thus can be said that, this study is positioned in the value-free axiological perspective.

The epistemological, ontological and axiological considerations of research philosophy are typified in Figure 5.2.

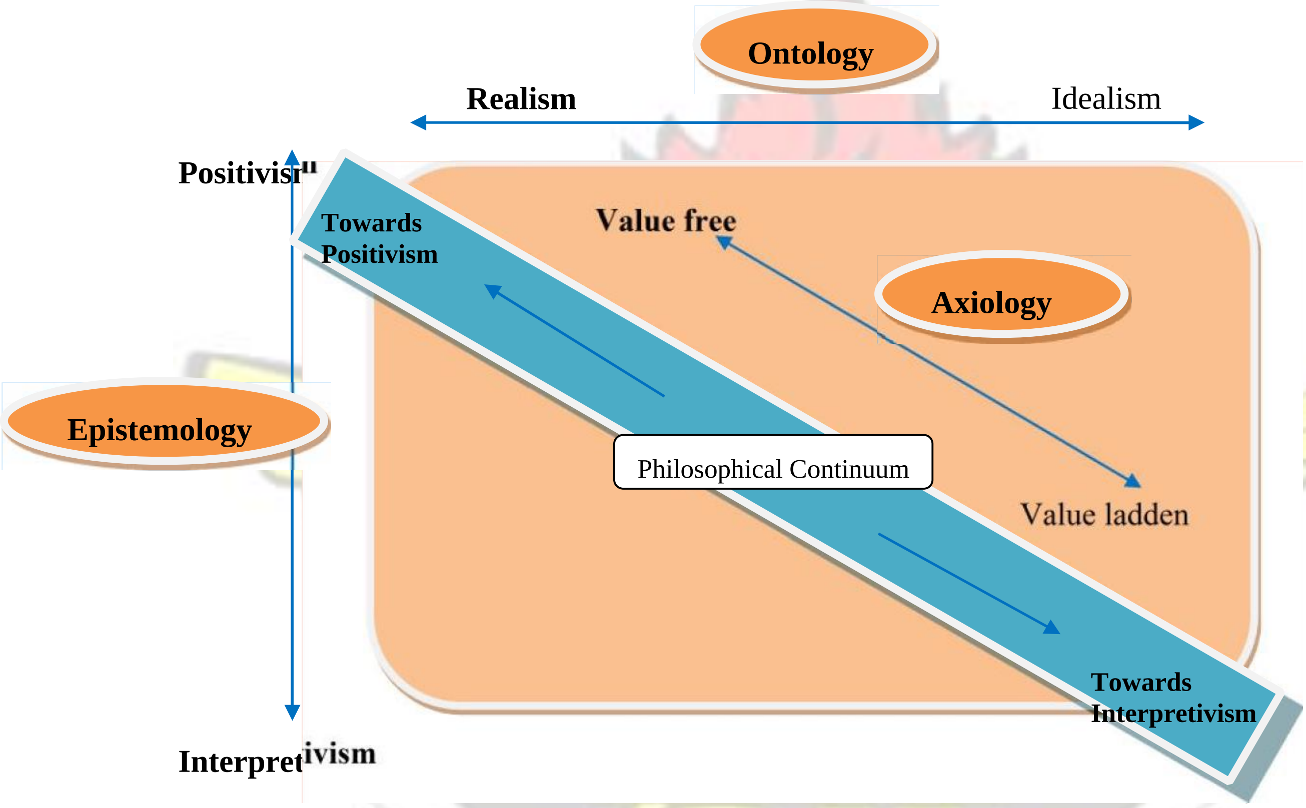

Figure 5.2: Continuum of Research Philosophical Assumptions (Cresswell, 2009)

5.3.4 Philosophical Position of the Study

By contrasting and comparing the philosophical positions outlined (see Figure 5.2), it can be said that, positivism employs observable approach in investigating causal relationships that leads to hypothesis and theory testing (Cresswell, 2009; Yin, 2009). It also studies a sample of the population that eventually leads to generalization to the whole population.

The interpretivism paradigm on the other hand, involves theory building and studies from larger perspective to focusing on the smaller unit without observing causal relationships among variables (Vanderstoep and Johnston, 2009; Cresswell, 2009). Drawing on this arguments and comparism, it can be deduced that, the research philosophy is principally concerned with the assumptions that a researcher employs to the systemic investigation and solving of the research questions.

From the epistemological, ontological and axiological evaluations of the research aim and questions presented in the previous sections and the choices made, it can be emphasized that, this study is underpinned by the positivist paradigm in the epistemological perspective and thus the realist ontological and value-free axiological positions augment the choice. Hence it can be affirmed that this study is positioned in the positivism domain. Additionally, from a critical synthesis of similar studies assessing communication performance especially in construction management practice, an objective, evaluative and predictive approach has been adopted as the most suitable and subsequently positioned in the positivist paradigm (see CII, 1997; Xie, 2002; Liu, 2009; Xie *et al.*, 2010). This resemblance explicitly supports the adoption of the positivism position for this study.

5.3 RESEARCH DESIGN

According to Cresswell, (2009), research design refers to a logical plan of information needed to offer the appropriate answers to the research questions in any study as well as showing how the information needed is collected and analyzed. The design offers a systemic and logical sequence through which the initial research questions are linked with the data collected as well as being able to interpret and draw valid conclusions from the study (Easterby-Smith *et al.*, 2003). Yin (2009) further affirmed that, the design serves as the central structure that guides and propels the most appropriate and suitable instrument for collecting and analyzing the data towards answering the research questions.

It is contended that, the choice of an appropriate method is crucial to the success of any study and the research design offers the solution to meeting this (Saunders *et al.*, 2009; Cresswell, 2009). Yin (2009) further asserted that, the choice of any particular design deemed suitable, must be explicit in addressing the research questions as well as expressing the causal correlations among the variables. In selecting the appropriate and suitable design for the study, the 'onion model' by Saunders *et al.* (2009) was used (see Figure 5.3).

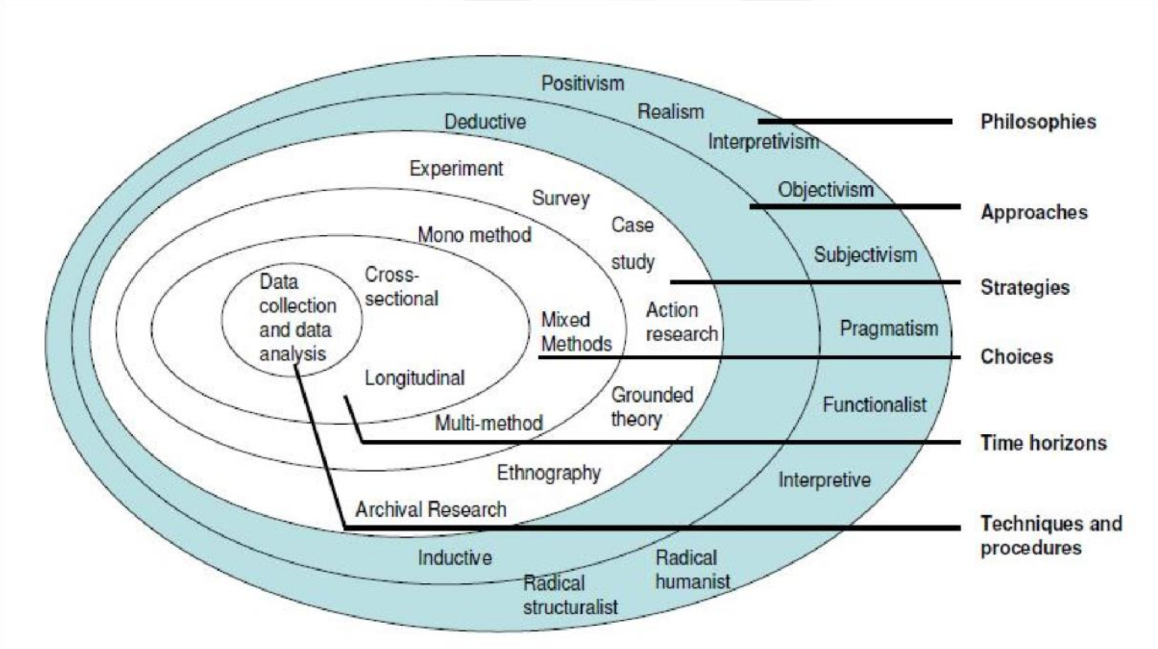

Figure 5.3: The Research "Onion Model"; Source: Saunders *et al.* (2009).

Saunders *et al.* (2009) perceived the onion to be of six layers which broadly classified 'philosophy' as the outer shell or envelope to the 'techniques or instrument' at the centre.

The model asserts that, the philosophy controls and influences all the other choices as the researcher approaches the centre. As already established that this study lies in the 'positivist' domain, this was followed to select the most appropriate, suitable approach and strategy for the research.

5.3.1 Characteristics and Nature of the Research Questions and CPMs

In deciding on the most suitable research design to meet the main objectives of the study, the characteristics and nature of Communication Performance Measures (CPMs) as well as the research questions were thoroughly assessed and evaluated. Drawing from literature, it can be asserted that Communication Performance measures are objective in nature and value free (Xie *et al.*, 2010; Liu, 2009; Xie, 2002; Murray, 2000). Hence the research questions and CPMs in general exhibit the following attributes:

- Establishing deductive correlations between identified variables.
- Investigates causal relationship among variables.
- Evaluative and predictive in nature
- Main questions it answers: What, Who, Where, How?
- Maintains independence of the researcher (see section 1.4 & 1.5)

From the attributes of the research questions as well as communication performance measures, it can be asserted that, the study leans towards the quantitative design.

5.4 RESEARCH APPROACH

In Cresswell (2009) and Baxter and Jack (2008), the importance of illustrating the research approach as an effective strategy to increase the validity of social research is strongly asserted. The choice of a suitable and appropriate research approach is influenced by the philosophical paradigm underpinning the study and this must always be resolved first (Saunder *et al.*, 2009; Bryman, 2009). It typifies the general approach to answering the research questions and solving the problem. From the Saunders et al. (2009) model, there are two main approaches to any research study. These are ‘deductive’ and inductive approaches (see Figure 5.3).

5.4.1 Deductive Approach

The ‘deductive approach’ employs a top-down approach in relation to theory formulation and testing of hypothesis (Naoum, 2002). According to Naoum (2002), this approach moves from the general to the specific in the phenomenon. It is also referred to as ‘quantitative method or design (Baxter and Jack, 2008). This approach employs mathematical and statistical techniques to collect data, analyze, identify facts and the causal relationships among variables to test hypothesis and draw conclusions (Naoum 2002; Neuman 2003; Creswell, 2009). It also leans towards hard positivist paradigm, involves scientific rigour and maintains the independence of the researcher (Oppenheim, 2003; Neuman 2003). In this approach, survey questionnaire and statistical tests are the most suitable and predominant instrument and analytical approach for the data collection involving sampling to generalize or draw conclusions (Oppenheim, 2003; Cresswell, 2009). It is also called "hard" measures and is most suitable for evaluation and predictive analysis using complex statistical techniques and inferences (Bryman, 2009; Cresswell, 2009).

5.4.2 Inductive Approach

The inductive approach on the other hand employs a bottom-up approach and moves from specific to the general (Naoum 2002). It also involves the observation of a phenomenon towards broad generalization and theory formulation and often referred to as qualitative approach (Baxter and Jack, 2008; Neuman 2003). This approach is subjective in nature, exploratory and maintains the full participation of the researcher (Creswell, 2009; Neuman

2003). It is also interpretive in nature and follows a non-linear research path that leads to a broad base generalization (Yin, 2009; Oppenheim, 2003; Neuman 2003).

Though case studies are sometimes applicable to the deductive approach it remains the most appropriate in inductive methods as wells as interviews (Yin, 2003). It is also called "soft" measures, is context driven and leans towards the interpretivism philosophical domain (Yin, 2009; Cresswell, 2009; Oppenheim, 2003).

5.4.3 Research Approach Chosen

In choosing the appropriate approach for this study, the two main paradigms were evaluated based on the philosophy as the main influence and the nature of the research questions and problem. From the main aim, the study involves identifying important concepts that were translated into observable variables and indicators to measure communication performance through quantitative empirical testing. Drawing on this exposition as well as the characteristics of the research questions, CPM (see section 5.3.1) and also being influenced by the adoption of the positivism philosophy for the study (see section 5.0), the 'deductive approach' becomes the most suitable in answering the research questions and was thus adopted.

5.5 THE RESEARCH STRATEGY

In the view of Creswell, (2009), the choice of the most suitable and appropriate research method should be based on the nature of the research questions or the research problem identified as well as the experience of the researcher and the audience of the study. This is also said to be inherent in the philosophical paradigm that underpines the study and thus must first be identified (Creswell, 2009; Bryman, 2009). Having adopted the positivism paradigm and deductive approach for the study, the next important step was to identify and choose the most suitable strategy (technique/method) available for data collection and analysis. According to Saunders *et al.* (2009), Bryman (2009) and Creswell, (2009), there are basically six main strategies applicable to any research study and by considering the philosophical stance and the context, the most suitable can be identified. These strategies are experiment, survey, case study, action research, ethnography and archival analysis. However, Blismas (2001) asserted that, four (survey, experiment, case study and action research) of the above strategies are most suitable, appropriate and are consistently recommended for social science and project management research in the construction industry and thus require an in-depth critique to select the most appropriate.

Case study, experiment and survey are the most suitable and widely used options in communication performance research in the construction industry (Azmy, 2012; Xie *et al.*, 2010; Liu, 2009, Hassall, 2009, Xie, 2002). Drawing on this, the three main strategies were thoroughly considered and evaluated to allow for a rigorous selection that is most suitable to answer the research questions.

5.5.1 Case Study

Case study is considered as a research technique that explores a single entity called "the case" through the use of variety of tools to collect data from 'the case' at a sustained period of time and is very suitable for an exploratory phase of a study (Saunders *et al.*, 2009; Yin, 2009). It also involves an in-depth, intensive analysis of a 'case' or 'multiple cases' (Yin, 2009; Neuman 2003). Yin (2009) emphasised that, case studies fit best for answering `how' and `why' questions and are most effective for inductive research approach and also reside in the interpretivism philosophy. However, inspite of case study being more suitable for inductive studies, it is sometimes used for quantitative research for descriptive purposes (Yin, 2009; Teddlie and Yu, 2007).

According to Yin (2009) and Teddlie and Yu (2007), case studies can take three forms or approaches, being exploratory, explanatory and descriptive. The descriptive case studies are purposely designed to describe a certain phenomenon whiles the exploratory type explores certain phenomenon (Yin, 2009; Sexton, 2004). The explanatory type is also used when an explanation inquiry is being sought on same set of events and how the explanations derived may apply to other phenomenon (Yin, 2009; Teddlie and Yu 2007; Sexton, 2004). The descriptive case studies may also be designed to answer questions such as "what", "who", "where", "how", and "why" about a phenomenon in ‘the case’ (Yin, 2009; Sexton, 2004; Easterby-Smith *et al.,* 2002).

5.5.2 Experiment

Experiment is a research instrument that involves finding causal relationships between variables through the effect of manipulating one variable on another (Bryman 2009; Cresswell, 2009). It is suitable for phenomenon with known variables or initial hypothesis that aimed at testing or manipulating a theory (Cresswell, 2009). It is also used to test and answer ‘How’ and ‘why’ research questions and lies in the deductive approach and positivism philosophy domain (Oppenheim, 2003; Easterby-Smith *et al.*, 2002).

5.5.3 Survey

Survey is a suitable research methodology that is efficient through the use of cross sectional and longitudinal studies to a common behaviour of phenomenon through a statistical analysis (Bryman 2009). It usually involves the use of samples as a representative of a larger population and is viable for investigating the relationships between variables, perceptions and predicting behaviours (Bryman 2009; Oppenheim, 2003). Surveys are also efficient in researches that are to demonstrate a causative relationship between an independent variable and a dependent variable without the researcher manipulating the independent variable (Oppenheim, 2003). According to Blismas (2001), survey instrument are efficient in enhancing the validity and reliability of research observations due to the use of standardised measurement (questions) and sampling procedures towards generalisation to a larger population. They are also deemed very effective for construction management research (Bryman, 2009; Blismas, 2001). It is suitable for answering ‘who’, ‘what’, ‘where’, ‘how’ questions and leans towards the

deductive approach and positivism paradigm and thus maintains the independence of the researcher (Bryman, 2009; Cresswell, 2009; Oppenheim, 2003).

5.5.3 Research Strategy Chosen

In order to choose among these three research strategies, (i.e. experiment, case studies and surveys), a critical evaluation in tandem with the main research questions (see section 1.5), the developed conceptual framework (see section 4.5), the charateristics of CPMs and Yin’s (2009) research design (see Table 5.1) was conducted. Yin (2009) outlined three main conditions as useful towards the choice of a suitable research strategy to answer any research question(s). These three conditions were used to evaluate the three potential instruments as presented in Table 5.1.

Table 5.1: Evaluation and Matching of Research Question Types and Strategies

Strategy	Type and nature of Research question	Requirement of control of behaviour Phenomenon	Should there be Focus on contemporary events
Survey	Who, What, Where, How, many, How much	No	Yes
Case Study	How?, Why?,What? *	No	Yes
Experiment	How, Why	Yes	Yes

Source: After Yin, (2009) * for descriptive Case studies

Drawing on the key research questions for the study, the controlled and manipulative nature of 'experiments' makes it unsuitable strategy for answering these questions and was thus discarded. This has suited CPM only when technology is being assessed (see Yang *et al.,* 2007; Mead, 1999). Surveys on the other hand involve far greater samples and are suitable for exploring, evaluating and predicting the relationships between variables, perceptions and behaviours through statistical data to enable generalization to the larger population on a phenomenon (Bryman 2009; Cresswell, 2009; Oppenheim, 2003).

Against the background of this argument as well as the nature of the research questions and characteristics of CPM (section 5.3.1), the theoretical perspective of this study entails the collection of data to be able to draw deep deductive conclusions about a phenomenon to develop an evaluative model. Also given that surveys reside in the positivism stance and leans towards the deductive paradigm, it is indeed considered the most appropriate in examining a causative relationship between an independent variable and a dependent variable without the manipulation of the independent variable by the investigator (Oppenheim, 2003; Trochim 2005). Against this background, the survey strategy becomes the most suitable choice for the study.

5.6 THE MAIN QUESTIONNAIRE SURVEY INSTRUMENT

Wilkinson and Birmingham (2003) affirmed that, research instruments are the tools used to collect, structure data and transform it into useful information through rigorous and systematic inquiry to aid interpretation of the research data. Trochim (2005) and Bryman 2009 further opined that, the research findings can be affected by the nature of instrument for data collection and thus the most suitable must be carefuly designed, administered and analysed.

In pensive analysis and critical consideration of the main constructs identified in the theoretical framework and the conceptual model (see section 4.5), it can be clearly stated that, two main variables were identified. These variables were the dependent variables and the independent variables. Against this background, the main data collection to meet the aim of the study was carefully structured to aim at inquiry into and identification of the causal relationship between these variables on communication performance outcome to answer the main research objectives.

Often, one of the most critical questions that needs to be answered in a questionnaire survey is who qualifies to take part in the exercise (Bryman 2009; Cresswell, 2009). It is very critical to identify the qualified population for this study. In mainstream human resource practice and management, the focus of performance measure mentions leaders and managers as main focus of the overall assessment. Traditionally in CPM, practitioners tend to focus on both the input and the output of the performance process (Liu, 2009; Xie, 2002). According to LeClair (2008), the focus of the input in the measure of communication performance is very useful for benchmarking skills, training and development. The lesson that is drawn from the outcome is that, it is a reflection of the efficiency and quality of the input to produce the outcome (LeClair, 2008). It can be said that, communication performance measure can be seen as an iterative process that is good for process and skill improvement by focusing on the quality and improvement in the input to register an expected outcome. Also the effectiveness of the outcome can be traced to the efficiency of the input as posited by the attribution theory (Weiner, 2006). Against this, an assessment of the overall performance remains the sole responsibility of the manager or the leader (Jubb and Robotham, 1997).

Against this background, the instrument was so designed to give a strong reflection of this in the measure as well as the necessary tests to meet the main aim of the study. It also focuses on project team leaders or managers of mass housing project teams as the nucleus of analysis who are in prime position to give an accurate assessment of the communication performance of the team. This assertion was influenced by the accepted norm in mainstream management and project management practice where the leader is responsible for the overall outcome and its assessment (Jubb, and Robotham, 1997; Ahadzie, 2007). The survey instrument was structured into four main components. They are the background and demographic component (section A), assessment of the communication problems on mass housing projects (section B), the contribution of the unique features to the communication ineffectiveness (section C) and the nature of the communication problems resulting from the influence of the features (section D).

According to Opeinhem (2003), it is always very crucial for questionnaires intended to elicit data for research to be clear, concise, unbiased, easy to answer and analysed to meet the research objective. Against this background, the instrument was designed to first express the rationale for the study to respondents on the first page as well as how the information given as contribution to the study would be handled and disposed. It also assured them of the confidentiality of the study. Additionally, all questions to be answered by respondent were constructed with simple and clear language so as to be easily understood. This was intended to draw accurate and precise response from respondents with clear understanding of each question. This helps to increase the validity and reliability of the data elicited (Creswell, 2009). The various parts of the questionnaire instrument put together constituted a 5 page document aimed at meeting the various objectives of the study. The structure of the questionnaire is presented in Figure 5.4.

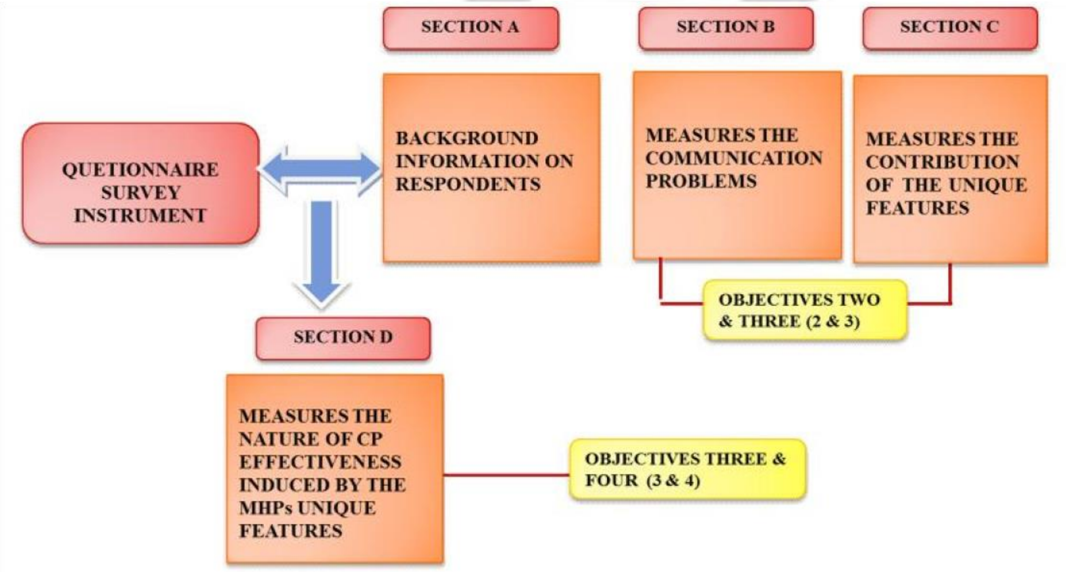

Figure 5.4: The Questionnaire Instrument Design Process

5.6.1 Pre-Testing of the Questionnaire Instrument

The designed Questionnaire instrument was pre-tested before the main survey. According to Creswell, (2009) and Oppenheim, (2003), pre-testing and pilot surveys preceding a main survey are very necessary to maintain and demonstrate a methodological and systemic rigour in data collection. It is also very important in ensuring face validity of the questionnaire in the survey (Creswell, 2009; Yin, 2009). The pre-testing of the instrument was aimed at assessing the clarity, comprehensiveness, the feasibility of the questionnaire and the survey as a whole as well as time taken by respondents to complete the questionnaire. This was intended to elicit feedbacks that are very crucial in smoothening the questionnaire and reduce ambiguity in the questions (Creswell, 2009; Oppenheim, 2003). This exercise is considered very crucial and thus very instrumental in avoiding any difficulty likely to be encountered in the main survey in the completion of the questionnaire (Creswell, 2009; Oppenheim, 2003).

By adopting a stratified sampling, 10 respondents with five (5) each from the Ghana Real Estate Development Association (GREDA) and academia & general construction industry with profound knowledge and experience in the subject area and the characteristics of the intended respondents were used to pre-test the Research Instrument (RI). The respondents for the pre-testing were to check the questionnaire for clarity, ambiguity and also the time taken to complete the questionnaire as well as make contributions that are intended to improve the face validity and accuracy of the instrument. The feedbacks indicate that the RI ensured both construct and content validity and it is more likely to elicit the relevant responses in the main survey. It further indicated that the questions and instructions are very clear and easy to understand. These feedbacks were used to fine tune the RI for the main survey. The results of the pre-testing have since been published.

5.6.2 The Main Survey Data Collection

Data collection remains one of the critical stages of a research process to answer the questions set for any study. According to Creswell, (2009) and Yin (2009), the success of any data collection process will depend on several factors such as the identification of suitable and potential respondents, the establishment and description of the appropriate sampling frame, the medium and the mode of conducting the fieldwork and finally, how the data collected is received, edited, coded and analyzed.

From the perspective of Azmy (2012), Liu (2009) and Xie (2002), a clear understanding of this simplifies and improves the validity and the reliability of the data collection process. This is because it is emphasized that, the quality of research findings are inextricably influenced by the quality of data collected and that efforts must be made to increase the validity and reliability of the data collected (Creswell, 2009; Openheim, 2003). Against this, the data collection process for the study was thus structured to embody four main sections described below.

5.6.2.1 Identifying the Suitable Survey Respondents

It can be said that the identification of suitable and appropriate respondents to participate in a research data collection process is very critical in maximizing both the validity and reliability of the results. Infering from the main aim of the study, it can be emphasized that, the group of persons to participate in this study are people who have knowledge, understanding and are involved in mass housing project delivery as project team leaders in Ghana as already justified in *section 5.6.*

In Ghana, there are three main bodies who actively undertake mass housing projects. They are the Government, Non-Governmental Organisation (NGOs) and Ghana Real Estate Association (GREDA). However, from the turn of the 1980s, the involvement of Government in active mass housing delivery has been non existent (Konadu-Agyemang, 2000). This is because government has not been able to make any single addition to housing supply since the turn of the 1980s as all initiated mass housing schemes remain uncompleted and abandoned (Konadu-Agyemang, 2000).

Unfortunately, delivery from NGOs has also been very erratic and no proper and efficient records exist on the organisations who are undertaking these mass housing projects. This makes identifying and contacting these NGOs very difficult and almost impossible. The effort of Quasi-Government institutions such as the Social Security and National Insurance Trust (SSNIT) in mass housing delivery is also acknowledged. However, in recent times, active delivery of mass housing either speculative or owner defined has been by the Ghana Real Estate Association (GREDA) in Ghana. Further to this, the government of Ghana has also identified GREDA as the main and key contributor to the national housing stock through mass housing delivery and thus has formulated policies to support and strengthen the GREDA to increase their out-put (BOG, 2007).

Against this, the study recognizes GREDA as the viable existing active contributor to mass housing in Ghana. GREDA is the umbrella body that controls and regulates the development of housing by private real estate developers in Ghana and maintains a register of all its members (GREDA, 2013). Based on this, the members of the GREDA were thus identified as the most relevant and appropriate participants to contribute to the study. From the perspective of the overall assessment of communication performance and the subsequent acceptance of the project team leader's roles in the overall communication,

it can be affirmed that the project teams leaders of the various GREDA members involved in mass housing delivery in Ghana are better placed to contribute to the study. This is because they are deemed to have considerable experience in such project environment and are more likely to have and portray detailed consistent knowledge and understanding of the communication protocols. They are also deemed to be consistent in understanding the communication procedures, nature of communication challenges and performance inherent in the uniqueness of MHPs project environment. Hence, here, project team leaders on mass housing projects constituted the unit of analysis given that they are more likely to accurately give better performance assessment and evaluations in their responses on communication in MHPs delivey.

5.6.2.2 Determining the Sampling Frame

As indicated in section 5.6.2.1, the registered members of GREDA were identified as the main participants of this study. It is always emphasized that, sampling is very necessary in any research study due to the constraints of time, cost and convenience (Cresswel, 2009).

The sampling frame was extracted from the 2013 version of the register of members of GREDA elisted from the secretariat of the association in Accra. The register consisted of 402 members distributed across all the 10- administrative regions of Ghana. The register contained the names, full addresses, telephone and mobile numbers and the e-mail addresses of the members.

From the register, it was deduced that over 96.8% of the registered members were based in the Greater Accra region. The remaining 9 regions account for the remaining 3.2%. This was also reported in a study by Ahadzie *et al.* (2014). Given the active contribution of the members in Accra to mass housing and the rather insignificant membership size in the other 9 regions, the field data collection in the survey was limited to the Greater Accra region. The sampling frame that was adopted for the selection of the sample was the list of active members of GREDA located in the Greater Accra region who were identified with the help and assistance of the GREDA secretariat. Following the example of Ahadzie (2007), all members on the register with incomplete contact details were ignored thus establishing a sample frame of 319.

5.6.2.3 Establishing an Appropriate Sample Size for the study

According to Tong (2007), sample size significantly affects model fit in Structural Equation Modeling (SEM) analysis and model testing. In this study, the SEM was adopted as the main analytical approach for the data analysis and the development of the evaluative communication performance model. Interestingly, suggestions and recommendations on what constitutes an appropriate sample size that will yield effective results towards model fit and testing in various circumstances have gone on for the past two decades (Bentler, 2005; Kenny and McCoach, 2003; Jackson, 2003). However, Tong (2007) further emphasize that, a smaller sample size contribute to a greater model fit bias and ineffectiveness. Noting that, the SEM will be the main analytical strategy in the analysis, this was criticaly evaluated in deciding on an appropriate sample size for the data collection. As noted by Bentler (2005), the quality of results inherent in a study with relatively small sample size will depend on the characteristics of the model under consideration.

Additionally, nature of statistical tests such as the parameter estimates, standard error, z-tests, test statistics, mediational effects yielding good results in an approximate order list further emphasize the quality of the results in a study (Bentler, 2005).

However, Iacobucci (2010) and Kline (2010) considerd a sample size of 100 cases as small and thus the resultant analysis tends to be very challenging as well as yielding undesireable results in SEM analysis. Iacobucci (2010) and Tong (2007) have noted that, in an effective SEM analysis, a sample size of 200 cases or more with a certain number of observed variables is considered very suitable guideline for a good fit model analysis. Essentially, several studies affirm that variable ratio remain very convenient towards the determination of appropriate sample size in SEM analysis (see for instance Hair et al., 2013; Kline, 2010; Tong, 2007; Bentler, 2005; Curran *et al.*, 2004). Against this, Tong (2007) and Bentler (2005) suggested that a variable ratio of an ideal SEM model should be at least 5:1 to be considered an appropriate sample size. This suggests that an SEM model with 20 observed variables should have more than 100 respondents as an appropriate sample size.

By following this background as a guide, the study at hand has 41 hypothesised observed variables (see appendix 1). Hence by considering the variable ratio of 5:1 for an ideal SEM model, a sample size of 205 can be considered appropriate and thus meets the recommendation by Bentler (2005) and Tong (2007). A total of 208 responses were received from project team leaders on mass housing project sites of 109 registered members. This is because several of the registered organisations had multiple sites with different team leaders managing the housing projects. To avoid the problem faced by Ahadzie (2007) when some of the GREDA members randomly selected were not active on the ground, a purposive sampling approach was adopted in the selection of only active GREDA members for the study.

5.6.2.4 Conducting the Fieldwork

As already indicated in section 5.6.2.1, the fieldwork which entailed the actual administration of the questionnaire was undertaken in the Greater Accra region where registered members of GREDA were purposively selected to respond to the questionnaire by their project team leaders at various mass housing construction sites. Two field assistants who were farmiliar with the workings of GREDA in the Greater Accra region were engaged to assist with the administration of the questionnaire. Physical visits were made to the companies' construction sites. In orientating the two persons for the task, it was made very clear that, they were to administer the instrument to only the project team leaders on the mass housing schemes of the companies as indicated on the questionnaire. The survey commenced on 20th April, 2014 and was intended to last for four weeks. By the 20th June, 2014, a total of 158 questionnaires were successfully retrieved from various project team leaders of the GREDA companies at various construction sites and offices.

This was considered inadequate due to the requirement of a minimum of 200 to aid the SEM analysis. Hence by consensus, the survey was extended to first week in August, 2014 to allow for an adequate response for the SEM analysis. Following this, a trip was made by the researcher to Accra to collect the additional responses making a total of 208 from 198 active GREDA members.

5.6.2.5 Data Entry and Organisation

Editing and organization of field data prior to the main statistical analysis improve the quality of the data and reduce the incidence of errors and inadequacies that are likely to affect the research findings and outcome (Yuen, 2007; Neuman, 2006; Cooper and Schindler, 2006). Following the checking and screening for the completeness of the questionnaires that were received, the data was entered into SPSS version 17. Although Missing Values (MV) and incomplete questionnaires are common in research and its occurrence may be ascribed to several reasons, there is the need to ensure that missing data does not affect the analysis in order to improve the validity of studies (Field, 2009; Hair et al., 2010; Bentler, 2005). Only two of the questionnaires registered a missing data for the years of experience. This did not pose any serious treats to the quality of analysis, interpretations and conclusions of the findings as these are not major items in the RI viza-viz the aim and objectives of the study.

Additionally, the SPSS software, is so programmed and can be configured to automatically control the impact of missing data and incomplete questionnaire. Following the successful entry and editing of the data into the SPSS software, the various test intended to analyze the data to meet the various research questions and objectives began.

The results from the analysis are presented in chapters, six and seven.

5.7 METHOD OF DATA ANALYSIS AND DEVELOPMENT OF THE MODEL

The data analysis process in any research study consists mainly of the tasks of organizing, examining, categorising, tabulating, interpreting, testing, etc. of data collected to elicit enough evidence that is intended to answer the research questions (Saunders *et al.*, 2009; Sexton, 2004; Easterby-Smith *et al.*, 2003). The data analysis in this study was structured into two main statistical analyses. The first part involved a thorough descriptive analysis of the background information contained in section A of the questionnaire instrument. Detailed inferential statistics were also conducted on sections B, C and D of the questionnaire to meet the main objectives of the study. This section has been structured into sub-sections that are intended to highlight all the various analysis to answer the research questions.

5.7.1 Analysis of the Background Information

This involved the descriptive assessment of the professions of the various project team leaders, experiences, type of management concepts and the number of housing units handled in their various schemes. These are very crucial in ensuring validity and reliability in quantitative studies. Frequency and percentages were used to analyze the background information.

5.7.2 Analysis of the Project Team Communication Ineffectiveness (PTCE) (Problems)

In determining the mass housing project team communication problems on MHPs, Mean scores and factor analysis were conducted on the responses given on section B of the questionnaire. By applying factor analysis, the main communication problems experinenced on mass housing projects inherent in the unique nature and attributes of MHPs were identified.

5.7.3 Choosing Appropriate Statistical Analysis for the Evaluative Model

This constituted the final part of the statistical analysis to evolve the intended evaluative model. To be able to meet the main aim of this study, it was important to draw on statistical tools and strategies that are robust in addressing the demands of the study. From similar studies of model development, General Linear Modeling (GLM), group of statistics such as Analysis of Variance (ANOVA), Multivariate Analyses of Variance (MANOVA) and Multiple Regression and Multilevel multivariate analysis such as Structural Equation Modelling (SEM) have been the dominant analytical approaches (Hair *et al.*, 2013; Kline, 2010; Field, 2009).

However, the strength and advantages of SEM over other GLM group of analyses in model development is that, SEM allows for conducting other multilevel multivariate analysis on variables and factors as well as revealing latent characteristics which are not possible in multiple regression and Analysis of Variance (ANOVA) (Kline, 2010; Haie et al., 2013; Byrne, 2006). Against this, the Structural Equation Model (SEM) technique was selected as the most appropriate and suitable tool for the development of the evaluative model. Also, the selection of the SEM ahead of Multiple Regression (MR) was motivated by the fact that it is able to reveal causal relationships among multiple variables compared to MR which is only very exploratory (Byrne, 2006; Bentler, 2005). It is a technique which is also very effective in analysis involving the direct and indirect assessment of one or more independent variable(s) on one or more dependent variable(s) as compared to MR which handles only one dependent variable (Bentler, 2005). SEM further reveals and determines a distinction between the true variance and the error variance which is very useful in model development (Bentler, 2005).

Bentler (2005) and Kline (2010) suggested that Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) are the most effective and very useful approaches in the analysis of the variables contained in the construct in SEM analysis. Their uses are also considered very crucial towards enriching the robustness in factor (measurement) model in SEM analysis (Kline, 2010; Bentler, 2005). However, it must be noted that EFA is useful in exploring the possible underlying factor structure of a set of observed variables without imposing a preconceived structure on the outcome (Byrne, 2006; Bentler, 2005). CFA on the other hand is useful to verify the already established factor structure of a set of observed variables and also allows the researcher to test the hypothesis that a relationship between observed variables and their underlying latent constructs exists (Bentler, 2005; Hair et al., 2013; Wong, 2011). In this study, it can be observed that the factor structure of the hypothesised evaluative model is already established on dependent factor of sixteen (16) observed variables in information flow and information composition constructs and five (5) independent factors of various indicator variables. Against this, CFA becomes the most suitable in analyzing the construct in the model and the underlying factor relationship among the dependent and the independent variables in the model.

For this study, the Confirmatory Factor Analysis (CFA) was first carried out on each exogenous variable to determine its best-fit for the model as emphasized by Bentler (2005). The study adopted the Equations softwares (EQS) version 6.2 for the SEM analysis. This choice was motivated by the flexibility of use and manipulation in the analytical process (Lei and Lomax, 2005; Lei and Wu, 2008). Additionally, the software allows for the benefit of utilizing the Satorra-Bentler scaled statistics ($S - B\chi 2$), which provides an adjusted and more robust measure of fit for non-normal data to yield trustworthy and unbiased results (Byrne, 2006; Kline, 2010; Bentler, 2005). It is also userfriendly in nature, provides a graphical user interface and compatibility with SPSS as well as offering a wider variety of goodness-of-fit measures compared to other softwares (Iacobucci, 2010; Lei and Wu, 2008; Bentler and Wu, 2002).

5.7.3.1 Model Analysis / Fit Indices/ Validity and Reliability

In SEM analysis, covariances analysis, score validity & reliability, measures of goodnessof-fit of model, test of significance and z-tests have been the main dominant techniques that have appropriately been applied to develop and evaluate models (see Hair et al., 2013; Kline, 2010; Bentler and Wu, 2002; Byrne, 2006; Field, 2009). Against this, and for the purposes of ensuring triangulation and theoretical validity which are critical in quantitative design, the study adopted the same approach. Additionally, in this study, it was very crucial to facilitate the ease of communicating the results as well as improving its validity and reliability (Dainty, 2008; Liu, 2009; Field, 2009), hence the model development and analysis adopted the use of multiple analytical techniques.

The raw data gathered from the questionnaire survey was fed into a Statistical Package for Social Science (SPSS) software (version 17) and later extrapolated to the SEM software EQS Version 6.2 for analysis (Bentler and Wu, 2002; Lei nd Wu, 2008). In helping to establish a robust model deemed fitting, statistical significance of the constructs underling the established framework were rigorously evaluated. The results from the statistical significance were expressed by the *p-values* (Kline, 2010; Hair et al., 2010; Bentler, 2005). Indeed, by convention and drawing from similar studies by Liu (2009), Ahadzie

(2007) and Azmy (2012), the *p-value* chosen in the present study is 0.05, which implies 95% chance that the population mean is within a listed range of values as noted by Field *(*2009).

Likewise, the study adopted a multi-approach to model fit assessment as recommended in literature (see Lei and Wu, 2008; Hair et al., 2014; Kline, 2010, Bentler, 2005). In SEM analysis, it is recommended that a critical appraisal of the hypothesised model should proceed the pre-analysis conditions, selection of the input matrix of the data and the method of estimation (Bentler, 2005; Byrne, 2006). The argument for the assessment of two index presentation strategy for model fit was put forward because it is affirmed to perform superiorly to a single index presentation strategy and that the most preferred type used in several published scholarly articles (Kline, 2010). Empirically, the measures of Chi-square (χ^2), Bentler Comparative Fit Index (CFI), Satorra-Bentler Scaled Chi-square ($S - B\chi^2$), Standardised Root Mean Square Residual (SRMR), Goodness of Fit Index (GFI), Root Mean Square Error of Approximation (RMSEA) and Root Mean Square Error of Approximation with its 90% or 95% confidence interval (RMSEA @ 90% or 95% CI) provide the most fundamental indication of how well the proposed theory fits the data (Kaplan, 2009; Bentler, 2005; Kline, 2010; Hair et al., 2014). However, experts of SEM recommend a mix of incremental or comparative fit indexes and absolute fit index (Byrne, 2006; Kline, 2010; Kaplan, 2009). The fit indexes of $\chi 2$, CFI, GFI and ($S - B\chi^2$) belong to the incremental or comparative fit indexes whereas SRMR and RMSEA on the other hand, emanates from the absolute fit indexes (Byrne, 2006; Kline, 2010). The SRMR and RMSEA additionally determine how well a priori model fits the sample data as well as demonstrating whether the proposed model has the most superior fit (McDonald and Ho, 2002).

In complimenting the suitability and appropriateness of choice, the study adopted four index evaluation strategies to offer a more robust assessment. These were the Goodness of Fit

Index (GFI), the Comparative Fit Index (CFI), SRMR and RMSEA denoting two comparative and two absolute fit indexes domain. This is indeed considered to ensure a more stringent and robust measure to evaluate the overall model fit as emphasized by Tong (2007) and Kline (2010). The χ^2 and normed χ^2 were also considered to assess the acceptance of the generated mode (Hair et al., 2014; Kline, 2010; Iacobucci, 2010). It is thus recommended that, a conventional GFI result closer to 0.95 or > 0.90 is preferred and suitable for model test of fit (Kline, 2010). Wong (2011) and Kline (2010) affirmed that the acceptable cut-off criteria of fit statistics should be: Chi-square (χ^2) Ratio to df ≤ 3 or 5 with an insignificant or significant *p value* ($p > 0.05$); CFI= value should be ≥ 0.95 for good fit and 0.90 for acceptable fit; SRMR= value should be ≤ 0.05 as good fit and ≤0.08 for acceptable fit (value of 0.1 is also acceptable); RMSEA= value should be < 0.05 for good fit (values < and 0.08 indicate a reasonable and acceptable error of approximation and values of > 0.10 suggests a poor fit) and RMSEA @ 90% CI= values to be < 0.05 to 0.08 with confidence interval.

In assessing the internal consistency and reliability of the constructs and measure, Cronbach's alpha coefficient and Rho coefficient were adopted (Kline, 2010; Bentler, 2005; Kaplan, 2009; Hair et al., 2013; Byrne, 2006). According to Field (2009), Byrne (2006) and Hair et al. (2013), Cronbach's alpha coefficient and Rho coefficient are extremely essential for testing the validity and internal consistency of items contained in a research questionnaire. The Cronbach's alpha coefficient was used to test the survey reliability (internal consistency) by measuring the single one-dimensional monotonic latent construct among the set of variables in the questionnaire (Kline, 2010). The adoption of the Cronbach's alpha coefficient was motivated by the fact that it is suitable

for measuring the degree to which responses are consistent across all items within a single measure (Kline, 2010; Byrne, 2006; Filed, 2005). However, Byrne (2006) argues that Cronbach's Alpha Coefficient alone is not very suitable for judging latent variable models especially models with multi-dimensional structure because it is based on a very restrictive model that requires all factor loading and error variances to be equal. It is also seen as unsuitable and limited in measuring internal homogeneity (Kline, 2010; Byrne, 2006; Field, 2005).

However, Kline (2010) and Byrne, (2006) affirmed that Rho Coefficient is very reliable in judging latent variable models especially models with multi-dimensional structure. This is motivated by the fact that it provides a good estimate of internal consistency in building and developing statistical models (Kline, 2010; Byrne, 2006). Given that the study under consideration contains latent variable models, both the Cronbach's alpha coefficient and the Rho coefficient were deemed very suitable for the analysis of the latent variables in the model.

5.8 MODEL VALIDATION

This section constitutes the final stage of the research process and is thus focused on the validation of developed evaluative model. Conducting validation on research findings is intended to increase, confirm and cement the extent to which the findings and results can be trusted and relied on (Bryman 2009; Saunders *et al.*, 2009). Several validation processes have been suggested in literature such as questionnaire survey, interview, focus group discussions etc (Lucko and Rojas, 2010; Bryman 2009; Saunders *et al.*, 2009; Trochim, 2005). It is asserted that, conducting a validation within the environment and through the same method with which the empirical data was collected is very useful and significant towards critical assessment of appropriateness of the results (Bryman 2009; Trochim, 2005). It also preserve the context within which the results can be applied (Bryman 2009; Trochim, 2005). Bryman (2009), Saunders *et al.* (2009) and Lucko and Rojas, (2010) further noted that using respondents either same or similar to those who contributed to the study for the validation of the findings has widely gained attention and acceptance as this method checks the findings and receives effective feedback from the respondents.

Following the examples of Ahadzie (2007), Liu (2009), Azmy (2012) and Manu (2012) which is in tandem with the method adopted for the data collection, the key findings of the study in the model were developed into a questionnaire which was sent to 10 respondents with rich understanding and experience in the mass housing in Ghana. The details and results of the validation process are reported in chapter 8.

In Figure 5.5, the summary of the analytical tools and processes conducted are presented.

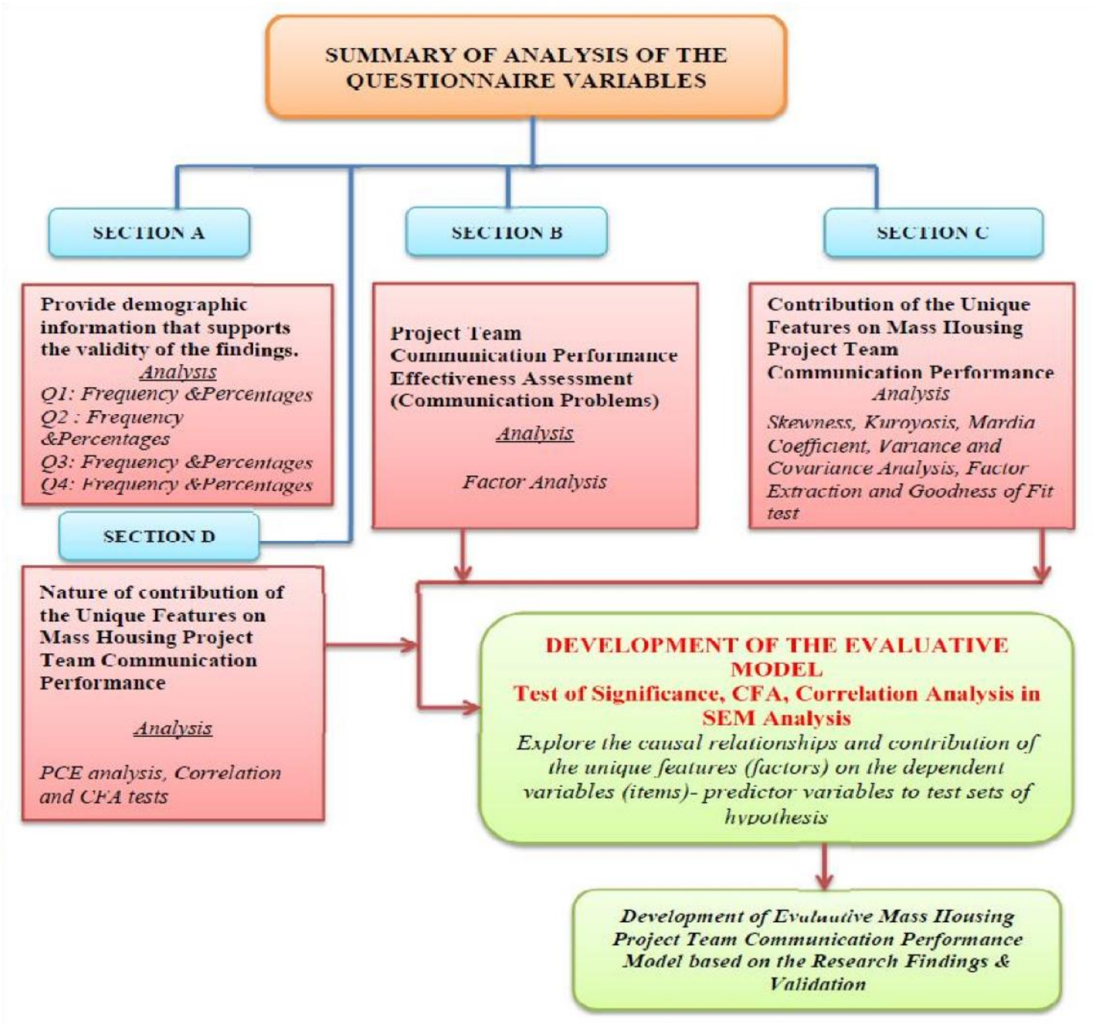

Figure 5.5: Outline and Types of Test and Analysis on Variables

5.9 SUMMARY

This chapter has introduced and discussed the methodology adopted to perform the study by extensively considering the philosophical, epistemological, ontological, axiological and the theoretical underpinnings of the study. The Positivist philosophical paradigm was adopted as the most appropriate stance for the study. The determination and the choices made in the research approach, design, strategy, administration of the instrument as well as logical presentation of the research process have also been clearly elucidated. The study adopted a deductive design culminating in the use of questionnaire to collect relevant data in a survery and applying SEM in the development of the evaluative model.

The next two chapters however focus on the analysis of the data elicited.

CHAPTER SIX

CHAPTER SIX

6.0 PRELIMINARY ANALYSIS, FINDINGS AND DISCUSSIONS

6.1 CHAPTER OUTLINE

By drawing on the appropriate practical experience and perceptions of active mass housing project team leaders, the questionnaire survey elicited the relevant data necessary for achieving the research objectives. This chapter is deployed to present, analyze and thoroughly discuss the subsequent results from the quantitative data elicited to answer the research questions and meet the study objectives. It presents the descriptive statistics, inferential statistics and hypothesis testing results based on the data gathered through the survey. The chapter is sectioned to begin with the analysis of the background information and concludes with the determination of the project team communication problems (ineffectiveness) among mass housing teams to aid in the development of the intended evaluative communication performance model to be considered in chapter 7.

6.2 DATA COLLECTION AND RESPONSE RATE

The assessment of the background of the respondents in a data collection survey is crucial in ensuring validity and reliability of the findings so as to draw valid conclusions and for generalization (Cresswell, 2009). It also helps to generate confidence in and credibility of the data collected (Hair *et al.*, 2010; Dainty, 2008; Bryman, 2009). As indicated in Chapter 5, the respondents were drawn from the Ghana Real Estate Development Association (GREDA) members who are active in delivering mass housing building projects in Ghana.

As indicated in section 5.6.2.4 of chapter 5, 208 questionnaires retrieved from the total 248 questionnaires distributed to various construction sites of sampled 198 active GREDA members reached represented a response rate of 83%. Similar studies by Ahadzie *et al.*, (2014 & 2007) yielded 37% and 55% response rate respectively. Hence, it can be said that this response rate recorded can be perceived as high and adequate for the statistical analysis. It should be noted that, this response rate was borne from the continuous follow up through phone calls, e-mails and personal visits to the respondents so as to yield the minimum of 200 responses required in SEM analysis.

6.3 ANALYSIS OF THE BIOGRAPHIC DATA

In order to gain a thorough understanding of the nature of the data, descriptive statistics in the form of frequency distribution and percentages were used to analyze the demographic data. This was to help provide an understanding of the profile of the respondents for the study and that their level of expertise and experience was suitable in according credence to their responses and the overall research findings. This is very useful in enhancing the reliability and credibility of the responses and results in a survey (Field, 2009; Bryman, 2009).

The part of the questionnaire assessing the background information had seven questions that related to the profession of the mass housing project team leader, educational background and qualification, the composition of the project team and the management stystem adoted on the mass housing scheme being managed. Also, the years of experience of the project team leader in mass housing projects, the experience of the mass housing development organization and number of housing units that is managed by the project team per single housing scheme. The assessment of these background information particularly years of professional experience and related education in construction are increasingly suggested as important indications defining the expertise and experience profiles of professionals in construction (Hallowell and Gambatese, 2009). The summary of the results of the background demographic data is presented in Table 6.1.

Table 6.1: Respondents' Professional Background, Qualification and Experience

Professional characteristics, Background Information & Experience	Frequency (n = 208)		Percentages	
Project Team Leader's Professional Background				
Project Manager	35		17%	
Architect	56		27%	
Quantity Surveyor	82		40%	
Civil Engineer	35		17%	
Project Team Leader's Educational Qulaification				
Higher National Diploma (HND)	29		14%	
Bachelor of Science (BSc)	100		48%	
Master of Science (MSc)	79		38%	
Composition of the Project Team	**YES**	**NO**	**YES**	**NO**
Project Manager	52	156	25%	75%
Architect	177	31	85%	15%
Quantity Surveyor	208	-	100%	-
Civil Engineer	133	75	64%	36%
Electrical/Mechincal Engineer (Services)	73	135	35%	65%
Main Contractor	164	44	79%	21%
Sub-contractor	125	83	60%	40%
Management system adopted on the Housing Scheme				
Traditional Method	56		27%	
Constrcution Management	82		39%	
Contract Management	35		17%	
Project Management	35		17%	
Experience in Mass Housing Development				
Up to 5years	23		11%	
6-10 years	108		52%	
11-15 years	42		20%	
16- 20 years	35		17%	

21 years and above	0	0
Experience of Organisation in Mass Housing Development		
Up to 5years	10	5%
6-10 years	74	35%
11-15 years	60	29%
16- 20 years	54	26%
21 years and above	10	5%
Maximum number of housing units you have managed per single housing scheme at one location		
Up to 25 units	4	2%
26-50 units	67	32%
51-75 units	78	38%
75- 100 units	47	22%
101 and above	12	6%

From the total of 208 responses realized at the close of the survey, professionals who were Project Managers acting as project team leaders on mass housing projects were 35 constituting 17% of the total respndents. From Table 6.1 above, 27% of the project team leaders were Architects whereas Quantity Surveyors as project team leaders were 40%. Similarly, 35 of the professionals acting as project team leaders on the mass housing projects were Civil Engineer constituting 17% of the respondents. The result on the professional background of the respondents can be said to give a fair reflection and representation of potential mass housing project team leaders across the main professionals in a project team in the construction industry. Hence, this is an indication that the perceptions given by the project team leaders on the variables in the study are more likely to be balanced across the various professionals.

The educational qualification of the project team leaders who responded to the survey as reported in Table 6.1 ranged from Higher National Diploma (HND) to Master of Science

(MSc) Certificate level. A total of 29 persons constituting 14% had HND and 48% (100 persons) out of the total respondents hold Bachelor of Science (BSc) degree. Also, professionals acting as project team leaders with Masters level qualification were 79 representing 38% of the total respondents. Drawing on the practical perspective of the training and the courses of the various professionals in the construction industry in Ghana, it can be deduced from the results that, all project team leaders have had tertiary level education with a greater proportion (100+79=179) having a minimum of a first degree. The likely antecedent of this is that, the educational background of the project team leaders can be considered adequate and are more likely to understand and give accurate interpretations to the variables and thus offer correct and consistent responses.

The team compostion on construction project is considered very crucial in defining the relative roles that are needed to complete a project (Azmy, 2012). In this regard the composition of the various team managing the mass housing projects were accessed by asking the project team leaders to list the various professionals that composed his/her team. From the 208 mass housing project construction sites from where the data was elicited, only 52 (25%) had project managers on their team. A total of 85% (177) architects were on the project teams managing the mass housing schemes. Interestingly, Quantity surveyors were found on all the project teams. Project teams with services engineers composed only 35% (73). On all the project sites surveyed, 79% had main contractors on the housing projects whereas only 60% of the sites had sub-contractors. Theoretically, all sites should have contractors. However, on some sites the direct labour approach was used. From this it could be suggested that there is a fairly effective representation of most of the professionals in the project team managing the various mass housing schemes and thus adequately represent the industry’s conventional practice.

According to Eriksson and Pesämaa (2007), the procurement and management concept adopted on a construction project significantly influences the success level. The results from the survey revealed four main dominant management styles adopted on the various mass housing schemes being managed. The assessment of the available responses given by the various project team leaders revealed 17% adopted the project management style, while 27% also adopted the traditional procurement management concept. Similarly, 17% of the project sites also made use of the contract management style on their various schemes. Likewise, 39% indicated construction management style as their management concept adopted on their mass housing scheme. From this as shown in Table 6.1, it clearly typifies that, the dominant management concept adopted on mass housing projects was the construction management style. However, drawing from the distribution of results among the various mamangement styles, it could be suggested that, the findings from the study are more likely to receive broad spectrum of the experiences on the subject matter across the various management concepts. This in nutshell is a very essential contribution to the validity and reliability in the generalization that is likely to be given to the study.

Besides, from Table 6.1, the experience of the project team leaders partaking in the survey showed that 11% (23 persons) had 0-5years of experience in mass housing delivery. A total of 108 persons (52%) have had between 6-10 years of experience. Project team leaders having between 11-15 years of experience were 42 (20%) whereas 17% (35) had between 16-20 years of experience. A critical examination of the banded breakdown of the background experience of the respondents (i.e. < 5 years, 6-10 years, 11-15 years, 1620 years and over 20 years) indicate that 89% of the respondents (majority) have atleast six years of experience in mass housing project delivery. In mainstream human resource management practice as well as drawing on the practical perspective of management practice and employment in Ghana, a minimum of six year of experience is considered adequate for senior management position whilst having ten years and above is suitable for executive positions. Drawing on this, a plausible conclusion is that, the respondents are well vested in the activities of mass housing delivery and are more likely to offer valid and reliable responses in the survey.

Likewise, the results further present the experience of the organisations the respondents belonged to in mass housing delivery. From the results, whereas 5% of the real estate organization indicated an experience level of up to a maximum of five years, the majority constituting 95% indicated their involvement in mass housing development for over five years. Similarly, more than half of the organizations had over ten years of experience. By an in-depth examination, it can be said that, this background experience of the respondents' organization indicates that they have been active in mass housing implementation and delivery and thus offer credence to their contribution to the study. Further to the background information, respondents were asked to indicate the maximum number of housing units they have managed per single housing scheme at one location. The last section of Table 6.1 illustrates the categories of housing units that have been managed by the respondents per schemes. Whereas 2% indicated up to 25 housing units in the scheme they managed, 32% had managed 26-50 units whereas the number of person who have managed 51-75 units were 38%. 22% had experience on 75- 100 units per scheme and the remaining 6% stated that they deliver 101 and above houseunits per scheme. From these details on the experience of housing units managed per scheme, approximately 68% of the respondents are said to manage over 50 housing units per scheme. According to Blismas et al. (1999), organizations whose primary activities are enabled by a geographically dispersed network of tasks encounter a unique situation when programmes are instituted to manage any construction work across the network. In such situations, Blismas (2001) further affirmed that, the geographical disparity, multiple repetitiveness of tasks and functions on such sites exacerbates the complexity of such programmes. Against this, it can be explained that, from the spectral distribution of the experience in the housing units per scheme managed, the results indicate that the respondents are more likely to have reasonable experience in the communication challeneges in the management of the schemes. Hence, they are more likey to reflect the practical and theoretical perspective of the mass housing project environment.

The results from the descriptive statistics indicate and demonstrate that, the respondents indeed have sufficient level of expertise and experience which is suitable in according credence to their responses on the variables and hence the overall research findings. Consequently, the respondents who also consititute the category of participants needed for the study, are very active in mass housing delivery and are more likely to offer credible responses in the data gathered.

6.4 INFERENTIAL STATISTICAL ANALYSIS OF DATA COLLECTED

The inferential statistics employed included factor analysis and Structual equation model (SEM) analysis. The factor analysis was used in the assessment of the communication problems (ineffectiveness) on mass housing projects. The Factors analysis is essential in revealing the underlying clusters of the communication ineffectiveness in order of their significance (Field, 2009). It is also considered a robust statistical analytical approach over mean scores and analysis of variance (Field, 2009, Motulsky, 2005), hence the motivation for it use here. The SEM, on the other hand, aided the development of the evaluative communication performance model which was conducted and presented in Chapter 7. Here, in this chapter, the Factor Analysis used in analyzing the communication problems experienced among the mass housing projects team as contained in objective 2 is presented.

6.4.1 Measuring the Project Team Communication Effectiveness (PTCE)

Assessment of the effectiveness of project team communication has become increasingly significant due to the growing technical and organizational complexity of construction projects especially projects of unique attributes such as Mass housing projects. It is considered as the foundational step in communication performance assessment in any context (Liu, 2009; Xie, 2002). It is accounted that, an assessment of communication problems in the communication process among project team provides an important step towards reaching communication effectiveness improvement through the identification and measurement of critical communication variables that are critical towards devising efficient strategies (Xie *et al.*, 2010; Liu, 2009; Xie, 2002). Hence this section has been set out to identify the communication problems among the mass housing project team due to the influence of the unique features and mass housing project environment.

6.4.1.1 Communication Performance Ineffectiveness (Problems) among the Project Team on MHPs.

The analysis of the communication ineffectiveness among the project team due to the influence of the mass housing unique features was based on the responses from the empirical questionnaire survey conducted. The communication performance among the project team was accessed by the frequency of the communication ineffectiveness which was expressed in the sixteen (16) operationalized communication performance indicators contained in the section B of the questionnaire. The results of the factor analysis are presented in the following sections.

6.4.1.1.1 ***Factor Analysis- Dominant Communication Ineffectiveness (problems)*** The application of the Factor analysis was to evaluate which of the variables could be assessing aspects of the same underlying constructs related to communication problems being experienced among the mass housing project team. The potential of Factor analysis to identify cluster of related variables as well as reducing large numder of variables into a more condensed and easily understood framework justifies its suitability (Field, 2009; Motulsky, 2005). By adopting a Principal component analysis (PCA) approach in tandem with similar studies (see Ahadzie *et al.*, 2007; Liu, 2009), the results of the main ineffective communication among the project team on mass housing projects are presented.

The factor analysis test was preceded by a Kaizer–Meyer–Olkin (KMO) and Bartlett test of sphericity to determine the sampling adequacy and the identity of the population matrix. These are conventional requirements for determining the trustworthiness and reliability of factor analysis results (Field, 2009).

Table 6.2: KMO and Bartlett's Test[a]

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.672
Bartlett's Test of Sphericity	Approx. Chi-Square	412.828
	df	120
	Sig.	.000

a. Based on correlations b. Cronbach's Alpha = 0.786

From Table 6.2, the KMO test yielded 0.672. According to Hair *et al.* (2014), the Kaizer–Meyer–Olkin (KMO) measure of sampling adequacy of 0.600 is considered very adequate and thus affirms the adequacy of the sample size for the factor analysis in this study. Ideally, a KMO value of 0.5 is recommended in literature for sample size adequacy to merit factor analysis (Field, 2009). Additionally, the result of the Bartlett test of sphericity recorded was 412.828 with an associated significance of 0.000 (see Table 6.2). The import of this is that, there are potential correlations among the variables and thus indicative of a reasonable potential cluster forming factors from the variables (Hair *et al.,* 2014; Field, 2009). Likewise, the significance of the sphericity value suggests that, the population matrix realized was not an identity matrix. Also a Cronbach's alpha of 0.786 was realized suggesting an acceptable level of internal consistency and reliability in the measures and the scale (Hair *et al.,* 2014; Field, 2009). Conventionally, a Cronbach's alpha of 0.70 is considered reasonably good for scale reliability and internal consistency of the instrument (Field, 2009).

Prior to conducting the PCA, communalities extracted on each variable were assessed and presented (see Table 6.3). The communalities are critical and useful in deciding the variables that have to be finally extracted (Field, 2009). This is because by connotation, the communalities typify the total amount an original variable shares with all other variables included in the factor analysis (Hair *et al.,* 2014; Field, 2009).

Table 6.3: Communalities Extracted

Communication Problems (Variables)	Initial	Extraction
Receiving conflicting information from team participants	1.000	.678
Lack of consistency in communicated information leading to lack of coordination among project team	1.000	.651
Lack of conciseness in communicated information among the project team	1.000	.313*
Misunderstanding of communicated information	1.000	.681
Receiving less information than expected from team participants for tasks	1.000	.758
Receiving more information than necessary for the tasks	1.000	.422*
Late delivery of needed communicated information	1.000	.638

Persistent distortion in meaning of communicated information	1.000	.651
Persistent change in content of communicated information	1.000	.451*
Lack of clarity in communicated information resulting in different interpretations	1.000	.585
Lack of coherency in communicated information resulting in different interpretations	1.000	.430*
Witholding of part of the information by the one who controls communication	1.000	.275*
Witholding of whole of the information by the one who controls communication	1.000	.466*
Difficulty in accessing communicated information from channels	1.000	.717
Difficulty in disseminating information among project team	1.000	.582
Lack of defined roles and responsibilities among members of the team leading to communication failure	1.000	.733

Extraction Method: Principal Component Analysis. * extractions less than 0.50

From Table 6.3, the average communality of the variables after extraction was 0.67. According to Field (2009) and Motulsky (2005), an average communality of the variables after extraction should be above 0.60 to support reliable results and interpretations in factor analysis. Hence, the communalities extracted support the use of factor analysis on the variables. Also, the conventional rule about communality values in factor analysis suggests that, a potential significant variable must yield an extraction value (eigenvalues) greater than 0.50 at the initial iteration (Field, 2009; Hair et al. 2014). This criterion determines the inclusion or removal of the variable for further detailed analysis. From the results presented in Table 6.3, six (6) variables had their extracted enginevalues less than the 0.50 cut-off point, suggesting that they do not explain much variance and thus were subsequently dropped from the analysis (Field, 2009; Hair *et al.,* 2014). The remaining ten (10) variables with communalities above 0.50 were carried to the factor analysis extractions.

Following the appraisal and the conclusion of all necessary and mandatory pre-checks and preliminary tests of sampling adequacy, population matrix identity and scale reliability, the data yielded from the questionnaire survey on the communication ineffectiveness among mass housing project team was tested. The test was conducted using the PCA approach by adopting conventional varimax rotation for robust results in factor analysis (Field, 2009). By following this approach, the eigenvalue and factor loadings were set at conventional high values of 1.0 and 0.5 respectively as suggested by Field (2009), Liu (2009) and Hair et al. (2014). Likewise, by adopting the latent root criterion on the number of principal components to be extracted, the total variance explained by the variables as contained in Table 6.4 indicate that, three components should be extracted from the data as their respective eigenvalues were greater than 1.00. Similarly, the Rotated Component Matrix[a] in Table 6.5 also affirmed three distinct component factors as each variable dominantly belonged to a unique factor (component). From this, it could be suggested that, these components that emerged could be perceived as the dominant underlining communication ineffectiveness experienced among mass housing project teams.

Table 6.4:Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.561	35.611	35.611	3.561	35.611	35.611	2.995	29.955	29.955
2	1.942	19.417	55.028	1.942	19.417	55.028	2.238	22.238	52.193
3	1.328	13.283	68.312	1.328	13.283	68.312	1.597	15.970	68.312
4	.726	7.265	75.577						
5	.645	6.446	82.022						
6	.565	5.652	87.675						
7	.451	4.508	92.183						
8	.411	4.109	96.292						
9	.313	3.129	99.421						
10	.058	0.579	100.000						

Extraction Method: Principal Component Analysis.
Source: Field Data

From the results presented in Table 6.4, the total variance explained by each of the three extracted component is stated as: the principal component one (1) accounted for 35.611% of the total variance whereas the second principal component accounted for 19.417% of the total variance. The third and final principal component extracted on the other hand accounted for 13.283% of the total variance in the measure of communication ineffectiveness experienced among the project team on mass housing projects. From this, it could be seen that, the total three components extracted cumulatively accounted for 68.312% of the total variance which is above the recommended minimum of 50% (Field, 2009; Ahadzie *et al.*, 2007; Motulsky, 2005). The Rotated Component Matrix in Table 6.5 reveals all the variables contained in the various components extracted.

Table 6.5: Rotated Component Matrix[a]

	Component		
Communication Problems (Variables)	**1**	**2**	**3**
Late delivery of needed communicated information	.896		
Lack of consistency in communicated information leading to lack of coordination among project team	.868		
Difficulty in accessing communicated information from channels	.859		
Difficulty in disseminating information among project team	.703		
Lack of defined roles and responsibilities among members of the team leading to communication failure		.834	
Persistent distortion in meaning of communicated information		.724	
Lack of clarity in communicated information resulting in different interpretations		.681	
Receiving less information than expected from team participants for tasks		.599	
Receiving conflicting information from team participants			.907

Misunderstanding of communicated information	.682

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 5 iterations.

The adoption of the rotated component matrix over the ordinary unrotated matrix was influenced by the ability to yield and achieve simple robust structure aiding easy identification and interpretation of results (Field, 2009). Besides, all the components extracted had more than one variable on it, suggesting that the results yielded are reasonable and devoid of complex structures (Field, 2009). Following a critical appraisal of the likely interrelations among the variables contained in each component and the factor loadings, a more suitable name that encapsulates the ineffective communication explained by the components was derived. By drawing on the relationship among the variables in each of the components, Component 1 was labeled 'Access to Information challenges. Component 2 on the other hand was labeled 'Challenges in flow of information' whereas Component 3 was named 'Import of information challenges'. In the following section, the discussion on the various components is presented.

6.5 DISCUSSION OF RESULTS

6.5.1 Component 1: Access to Information challenges

From Table 6.5, four communication ineffectiveness indicators were extracted for this component. The variables in this component and their respective factor loadings in brackets were Late delivery of needed communicated information (89.6%), Lack of consistency in communicated information leading to lack of coordination among project team (86.8%), Difficulty in accessing communicated information from channels (85.9%) and Difficulty in disseminating information among project team (70.3%). From Table, 6.4, the cluster of variables in this factor accounted for about 35.611% of the total variance in communication ineffectiveness among the mass housing projects team. It could be deduced that the variables in the component explains communication

ineffectiveness related to untimeliness, information inaccessibility and inconsistencies. According to Dainty *et al.* (2006), timely delivery of project related information being communicated is considered very crucial to the smooth progress and success of construction projects in the construction industry. Hence untimely communication can be of adverse effect to project performance. From the results, 'late delivery of needed project

related communicated information has been identified as a very significant communication issue among mass housing project teams. Studies by Xie *et al.* (2010) and Liu (2009) revealed that, late delivery of communicated project related information required by project participants was common on traditional construction projects in Hong Kong. This finding suggests that the experience of late delivery of communicated information is common to both traditional 'one-off' projects and mass housing projects. It

is emphasized that timely delivery of project related information is crucial towards building trust and improving team productivity (Henderson, 2008), communication satisfaction among work groups, teams and employees (Madlock, 2008) and team cohesion at the design and construction stages (Gorse and Emmitt, 2007).

Dainty *et al.* (2006) and Gorse and Emmitt (2007) also established that, the communication medium adopted on construction projects significantly influences the timeliness of shared communication. However, Azu (2014) revealed that, face-to-face meeting, telephone conversation and personally delivering project related information remain the dominant medium used on mass housing projects. It can be said that these media are perceived as traditional ones which unfortunately contribute to delays in information delivery (Liu, 2009). Practically, from the result, it can be suggested that, late delivery of communicated information indeed provide evidence to the degree of potential influence of mass housing unique features especially multiple project sites for housing units, different geographical location and nature of communication infrastructure on sites.

Similarly, mass housing projects exhibit seemingly complex project relationships inherent from their procurement styles adopted (Oladapo, 2002; Ogunsanmi, 2012). Traditionally, mass housing project delivery in the Ghanaian context involves the packaging of housing units under different construction contractors in different geographical locations and multiple sites management under the control of same project teams. This means that sharing of communication is done across different sites and locations. Indeed, Blismas (2001) and Ahadzie *et al.* (2014) affirmed that the multiple construction site nature of construction projects especially mass housing, presents unique communication challenges often leading to delays in receiving information. Hence, these could be plausible attributions for the untimeliness in communication among the project team.

Also, other variables which together account for significance variance in communication ineffectiveness relate to lack of coordination and barriers to accessing communicated information on mass housing projects. Studies by Xie (2002) revealed that lack of coordination in project communication was the most dominant communication problem among project participants at the design phase. The development was primarily attributed to the lack of role and team co-ordination, conflicting information and poor communication skills (Xie, 2002). Liu (2009) on the other hand, affirmed that, project document management and arrangement of organizational structures are the main contributors to communication barriers on construction projects in Hong Kong and China. The emergence of barriers here is an indication that, communication dissemination and information accessibility problems are prevalent on both traditional projects and mass housing projects. On the contrary, Xie *et al.* (2010) revealed that, communication problems relating to barriers to information was not common at the construction stage among the design team in traditional construction building projects. Drawing on the practical and theoretical perspective of the construction industry in Ghana, project related information have traditionally been distributed by post or at meetings which are predominantly organised monthly. In recent times, communicating project information among the project team by the use of the internet has become an emerging channel and trend in project delivery in Ghana. However, practically at most mass housing construction sites, there are no access to reliable internet service as compared to the main offices of the mass housing developing organisation. Hence, plausibly, this is likely to account for the occurrence of this communication problem among the team on mass housing projects. This is because, lack of reliable internet access hinders the easy and timely access to shared information on mass housing projects at the construction sites.

Given that, in Ghana, untimely communication of project related information has been identified as the dominant factor contributing significantly to project delays and failures across various project typologies (Fugar and Agyakwah-Baah, 2010), it is of prime importance for mass housing stakeholders to be interested in developing and adapting emerging media capable of improving timely delivery of communicated information among project teams.

6.5.2 Component 2: Challenges in flow of information

Component 2 which accounted for 19.42% of the variance had its respective loading factors as: Lack of defined roles and responsibilities among members of the team leading to communication failure (83.4%), Persistent distortion in meaning of communicated information (72.3%), Lack of clarity in communicated information resulting in different interpretations (68.1%) and Receiving less information than expected from team participants for tasks (59.9%). This component was subsequently named Lack of defined Protocols and Distorted Communication. Dainty *et al.* (2006) hinted that established protocols and defined roles are necessary for effective communication on construction projects.

Procedure in communication as used here refers to the existence, use, and effectiveness of formally defined procedures and protocols that facilitate the sharing of project related information among the team. From the results, 'lack of defined roles and responsibilities among members of the team leading to communication breakdown therefore emerged as the significant and most critical factor in this grouping. This finding is contrary to the report in several studies (see Xie, 2002; Xie *et al.*, 2010; Liu, 2009; Dawood *et al.*, 2002). The results indicate that, lack of defined roles among the project team is a dominant procedural communication problem in mass housing delivery than on traditional projects. Consequently, the emergence of communication problems relating to procedure dominant on mass housing projects demands deeper insight. It can be argued that, the emergence of this is more likely to be the influence of the multi-cultural nature of project teams and strong attachment of teams to their discipline and organizations. This according to Ochieng and

Price (2010) and Javidan and House (2001) leads to lack of collectivism and eventually lack of team integration. This development makes adopted procedures and protocols for team function very difficult to operate due to strong attachement to traditional organizational culture and multi-culturalism among the team. This supports the assertion that, strong cultural diversity among project team leads to poor communication and task break down (Ochieng and Price, 2010; Diallo and Thuillier, 2005; Javidan and House, 2001).

Additionally, the results revealed that distorted and incomplete communication were also experienced in mass housing delivery among the project team. Xie *et al.* (2010) and Xie *et al.* (2000) revealed that distorted communications are common on construction projects and this is often due to the influence of varying background and technical language of the professional team. However, the result here in respect of completeness of communicated information is contrary to the account from Xie *et al.* (2010) and Liu (2009). This indicates that, whereas communication underload is a major communication problem among mass housing project team, it rarely happens on traditional construction project (Liu, 2009; Xie *et al.*, 2000). However, Gluch and Raisanen (2009) indicated that overcoming communication distortions and incomplete communication is very crucial in the performance of tasks and the progress of the overall project. Given that distorted communication has been arguably identified as very significant communication problem in this factor, it is thus no denying the fact that, stakeholders must not overlook this revelation. Given the significant role clear undistorted communicated project related information plays in project delivery, it is considered very crucial for mass housing project teams and stakeholders to make appropriate choice of communication planning and strategies towards ensuring effective communication.

6.5.3 Component 3: Import of information challenges

The third and final component 3 accounted for 13.28% of the variance with the factors and their loadings in bracket as: Receiving conflicting information from team participants (90.7%) and Misunderstanding of communicated information (68.2%). This component was named conflicting communication and misunderstanding. Conflicting information has to do with the accuracy of the communicated information (Xie *et al.*, 2010; Dainty *et al.*, 2006). From this factor component, 'receiving conflicting information from team participants' emerged as the most dominant communication problem among mass housing project teams contributing about 91% of the factor. Issues of inaccurate communication emanating from conflicting information shared among construction project teams have well been acknowledged and reported in literature (see Xie *et al.*, 2010; Liu, 2009; Dawood *et al.*, 2002). The dominance of this problem suggests that, it is a common problem experience among teams across various project typologies in the construction industry.

Similarly, the results indicated that, misunderstanding communicated information was a problem among the team contributing to about 68% of the communication problems in the factor. This finding however, contradicts studies by Liu (2009) and Xie *et al.* (2010) where misunderstanding was among the least problems among the project team at the construction stage. Additionally, Baldwin *et al.* (1996) previously indicated that, misunderstanding is not common in construction organizations and project teams especially at the construction stage. However, with the revelation of misunderstanding communicated project information among mass housing project team provides empirical evidence to the unique project environment compared to traditional building projects. Indeed just like accuracy of project information, the core significant of attaining clear understanding of shared information is towards performing tasks and actions to achieve zero variance in outcome (Dainty *et al.*, 2006). Against this, Xie *et al.* (2010) and Liu (2009) indicated that construction design and management is a typical interaction process which involves multi-disciplinary team participants from different domains (specialists), disciplines, organizations and cultures. This undoubtedly has been identified to significantly influence the ease of understanding of related communication shared among this multi-disciplinary team (Xie *et al.*, 2010). However, from the practical and theoretical perspective of training of the core professionals (architects, Quantity Surveyors, engineers etc.) of the built environment in Ghana and other countries, it can be said that there are lines of technical, cultural and work language diversities. Significantly, Xie *et al.* (2000) established organizational and cultural diversities, poorly defined information requisition and different discipline background as the major barriers to understanding communicated project information among construction teams.

Invariably, the occurrence of distortions and misunderstanding in communication among the project team can likely be traditionally traced to the fact that mass housing projects delivery involves a multi-disciplinary team approach with varying cultural, professional, technical, social and organizational background as well as variations in technical languages (Ogunsanmi, 2012; Zairul and Rahinah, 2011; Khanzadi *et al.*, 2008).

Similarly, these participants tend to lack the clear understanding of the unique attributes and challenging project environment of mass housing projects and their implications for management. Given the significance of understanding of project information among the project team, it is thus crucial for project teams to gain pre-existing patterns of work activities, specialized work language, overcome technical constraints and reduce organizational diversities. Without this, it is more likely for the multi-disciplinary team to persistently encounter misunderstanding of each other and related communication. Against this, gaining and developing common communication skills across all professional disciplines could be a valuable asset to mitigating distortions and misunderstanding of communicated information among construction project teams especially on mass housing projects.

6.5 SUMMARY OF FINDINGS

Against the background of limited or no empirical studies on identifying the communication problems among mass housing project team inherent in the unique attributes of mass housing projects, this study has sought to fill the knowledge gap. By adopting quantitative survey design, the study has empirically identified the communication problems among mass housing projects teams. By using factor analysis, the significant communication ineffectiveness experienced among mass housing project teams have been determined to be three main clusters, named as: component 1: Access to information challenges, component 2: Challenges in flow of information and component 3: Import of information challenges. Consequently, the findings recorded in this study indicate that though some of the results seem obvious, it also further brought to light some important findings which have not so far been empirically examined in the field of construction project management practice especially on projects of unique particularities. Consequently, these findings additionally lend support and confirmed some obvious communication ineffectiveness experienced in the general construction industry especially on traditional construction projects. More specifically, the results also highlighted some communication problems which were peculiar to the mass housing project environment.

CHAPTER SEVEN

CHAPTER SEVEN

7.0 DEVELOPMENT OF EVALUATIVE MODEL FOR CONTRIBUTION OF UNIQUE FEATURES OF MASS HOUSING ON MASS HOUSING PROJECT TEAM COMMUNICATION PERFORMANCE

7.1 CHAPTER OUTLINE

The previous chapter determined and explained the main communication problems encountered on mass housing projects. Here in this chapter, the development of the substantive evaluative communication effectiveness model as well as the empirical assessment of the contribution (effects) of the unique features of mass housing to the communication ineffectiveness are thoroughly explained. Various functions and statistical assessment under the SEM approach were all conducted to aid in developing a well fitting and acceptable model. The chapter subsequently ends with an in-depth discussion of the significance of the findings as well as the implications for practice and stakeholders in general in the mass housing industry.

7.2 STRUCTURAL EQUATION MODELING (SEM)

SEM suggests Path analysis model and Measurement model as the two dominant approaches to testing hypothesized models (Hair *et al.*, 2013; Wong, 2011; Kline, 2010; Bentler, 2005). However, the choice of any type is strongly motivated by the underlying construct of the study and three necessary conditions of degree of association, isolation and directionality which demonstrate causality (Hair *et al.*, 2013; Kline, 2010; Bentler, 2005).

Measurement (factor) models are more suitable for operationalizing and testing theory in complex hypothetical latent constructs (Kline, 2010; Hair *et al.,* 2010; Bentler, 2005). Path model on the other hand, contains only observed variables, each variable only has one indicator and also assumes that all variables are measured without error (Kline, 2010, Bentler, 2005; Bentler, 2005). Hair *et al.* (2010) however argued that, measuring construct through the use of statistical tools and analysis cannot be without error and thus makes path model not very efficient as well as not suited for behavioural measures such as psychology, communication, education, intelligence etc. Conversely, path models are most suited for linear causal relationships (directionality) and are unable to show degree of association and isolation (Hair *et al.*, 2013; Wong, 2011; Lei and Wu, 2008). On the contrary, measured (factor) SEM models use latent variables to account for measurement error in order to make them more fitting and effective to measure the construct (Wong, 2011; Kline, 2010; Hair *et al.,* 2010). In the context of this study, it can be said that a thorough and critical appraisal of the variables contained in the instrument reveal unobserved latent factors (exogeneous and and endogeneous) which cannot be measured directly but rather are indicated or inferred by responses to a number of observable variables (indicators).

Additionally, it can be emphasized that, the evaluation and measurement of communication performance effectiveness is a complex construct (Marshall-Pointing and Aouad, 2005). Subsequently, the study has been designed to examine the contribution of the unique features of mass housing to project team communication effectiveness with factor models indicated by series of observed variables defining the factors (see Figure 7.1). This attribute makes measured (factor) model more suitable for the study as it is able to predict, evaluate and depict complex causal relationships (directionality), degree of association and isolation of the latent variables on the indicator factors and dependent variables in a complex hypothetical constructs (Lei and Wu, 2008; Kline, 2010; Bentler, 2005; Wong, 2011). These given merits informed the decision to utilize factor (measurement) SEM in conjunction with Equations (EQS) software 6.2 version to evaluate the contribution of the unique features of mass housing to project team communication effectiveness.

7.2.1 Structural Equation Modeling Analytic Strategy

Hair et al. (2013 & 2010) and Kline (2010) emphasised that, structural equation modeling (SEM) should follow a clear process and analytical strategies that meet the hypothesized construct model. In general, every SEM analysis goes through the steps of model identification, model specification, data collection, model estimation, model evaluation (hypothesis testing), and (possibly) model modification (Kline, 2010; Bentler, 2005). According to Kline (2010) and Bentler (2005), a factor model with various factors can be decomposed into several sub-models of each of the factors. In other words, factor or measurement models treat each factor and its related indicator latent variables as submodels that together compose the main model under estimation (as in Figure 7.1). Hence, it is recommended that, the efficient approach to the analysis and estimation of such model is by first analyzing each of the sub-models to determine how each factor fits the main model before proceeding to the main model assessment (Byrne, 2006; Kline, 2010).

Kline (2010) and Bentler (2005) advised that, following the identification of the model and the data collection, the latent factor (measurement) models in the construct must first be analyzed before the analysis of the full SEM model to ensure the building and development of effective and fitting model. This is termed as the two-stage approach to model analysis in SEM (Bentler, 2005; Byrne, 2006; Kline, 2010). This approach is considered to be very effective and efficient in developing and minimizing the error tendency in the overall model fit (Hair *et al.*, 2010; Henseler and Sarstedt, 2013). Additionally, studies by Frank and Hennig-Thurau, (2008) and Markland (2007) sternly emphasize that in SEM analysis where theoretical foundation underpines the survey and the hypothesised model, the analysis and model evaluation must rely on Comfirmatory Factor Analysis (CFA) or Exploratory Factor Analysis (EFA) to ensure unidimensionality of the model, followed by scale reliability tests as well as construct validity of the factors before the main model assessment.

Drawing on the merits of the arguments above, the study adopted the two-stage approach in the model analysis as it is proven to be effective in avoiding model miss-fit and cumbersome model modification that may render the overall model unsuitable and unexplainable (Bentler, 2005; Byrne, 2006; Hair *et al.*, 2013). As already justified, this study adopted the CFA approach to the evaluation of the model (see section 5.7.3). Expert advice on SEM analysis reveals that the most effective approach to model assessment where CFA is ideal is to conduct an assessment of the factor structure, goodness of fit index, significance of the parameter estimates, amount of explained variance, factor loading and residual analysis (Hair et al., 2013; Kline, 2010; Markland, 2007; Byrne, 2006; Bentler, 2005). Hence, the first stage entailed a series of test analysis involving Residual Covariance & Correlation Estimate analysis, Goodness-of-Fit Statistics, Statistical Significance of Parameter Estimates and Internal Reliability and Validity of Scores to explore and test the measurement equivalency for each of the five (5) factors and the manifest (indicator) variables of Project Team Communication Effectiveness (PTCE) represented in the hypothesized model in Figure 7.1. As noted by Hair *et al.* (2013), Kline (2010) and Bentler (2005), these assessments define the relations between the observed and unobserved variables and also reaffirm the factor structure of the observed and unobserved variables thus ensuring the construct validity.

By following the CFA approach, Lei and Wu (2008) and Kline (2010) suggested that the thorough assessment of the fit of the entire measurement model underlying the hypothesized structural model is crucial in ensuring that the model does not contain any redundant components. Drawing on this axiom, the second step in the Structural Equation Modeling Analytic Strategy involved the testing of the full model fit for the underpinning hypothesized construct. This was done to determine and explain which and how each exogenous variable (unique features) directly contributes to changes in the values of the endogenous (dependent) variables (PTCE). These analyses were aided by a comparative assessment between the covariance matrix generated from a particular sample and the covariance matrix generated from the hypothesised model as well as the use of fit statistics to determine the acceptability of the solution obtained (Kline, 2010).

7.2.2 Statistics on SEM Assumptions – Data Distribution Characteristics

Bentler (2005) and Byrne (2006) established that the Data Distribution Characteristics (DDC) usually informs the estimation method to be adopted in SEM analysis. Most SEM software packages assumes multivariate normality and that, to have good results towards the most suitable good-fit model, it is extremely crucial to first examine the distribution characteristics of the data before adopting a fitting estimation method for the model analysis. This has been supported by studies such as Hair *et al.* (2013), Henseler and Sarstedt (2013), Kline (2010) and Frank and Hennig-Thurau (2008). From this background, Bentler (2005) suggested that statistical measures such as Mean, Skewness, Kurtosis, Standard Deviations, Standard Mean Error, Univariate & Multivariate Kurtosis and Skewness, Mardia based multivariate Kurtosis are useful in the analysis of DDCs of the latent variables. Consequently, SEM analysis assumes both univarate and multivariate assessment of data to ensure trustworthiness of model estimation and results (Kline, 2010; Gao *et al.*, 2008; Bentler, 2005). Hence, in this study, both univariate and mulivariate assessments were carried out to reveal the true characteristics of the data elicited in order to adopt the most suitable model estimation (ME) approach. Preliminary assessment of the data characteristics and the results are presented in Table 7.1.

Table 7.1: Univariate and Multivariate Assessment and Estimates of the Factors

Factor Constructs	Indicator Variable	Mean ($\bar{x}$)	Skewness (G1)	Kurtosis (G2)	SD (σx)	S.M.E	Mardia's coefficient
MULTIPLE SITES MANAGEMENT STYLE FEATURES (MCS)	*MCS1*	3.78	.195	-.726	.708	.046	-1.8374
	MCS2	3.66	.200	-.522	.603	.040	
	MCS3	3.63	-.239	-.504	.848	.056	
	MCS4	3.64	.066	-.303	.694	.046	
	MCS5	3.62	.138	-.369	.717	.047	
	MCS6	3.69	-.048	-.286	.589	.039	
	MCS7	3.92	-.371	.280	.692	.045	

HOUSING UNIT DESIGN CONTRACT PACKAGING- FEATURES (HDP)	*HDP1*	3.78	-.065	-.349	.720	.047	1.2521
	HDP2	3.34	-.151	-.496	.746	.049	
	HDP3	2.98	.233	-.519	.926	.061	
	HDP4	3.15	.439	-.336	.850	.056	
	HDP5	2.70	.167	-.477	.693	.045	
	HDP6	2.78	.277	-.237	.898	.059	
MULTIPLE GEOGRAPHICAL LOCATION FOR VARIOUS SCHEMES FEATURES (MGL)-	*MGL1*	3.15	-.149	-.625	.644	.042	
	MGL2	2.94	.153	-.466	.796	.052	
	MGL3	2.31	.347	.265	.804	.053	.2310
	MGL4	2.69	.262	-.029	.848	.059	
COMPLEX NETWORK OF PROCUREMENT SYSTEMS FEATURES (NPS)	*NPS1*	3.91	-.680	1.042	.691	.045	
	NPS2	3.92	-.378	-.026	.746	.049	
	NPS3	3.96	-.250	-.380	.743	.049	.5669

Table 7.1 Cont'd

Factor Constructs	Indicator Variable	Mean (x̅)	Skewness (G1)	Kurtosis (G2)	SD (σx)	S.M.E	Mardia's coefficient
	NPS4	3.94	-.354	.602	.639	.042	
	NPS5	4.03	-.787	.865	.755	.050	
	NPS6	4.23	-.763	.010	.782	.051	
REPETITIVE TASKS MANAGEMENT DELIVERY STRATEGY FEATURES (RDS)	*RDS1*	3.94	-.244	.664	.589	.039	
	RDS2	3.86	.080	-.584	.670	.044	
	RDS3	3.93	-.587	.602	.723	.047	
	RDS4	3.24	.287	-.670	.898	.059	.4208
	RDS5	4.03	-.313	.253	.657	.043	
	RDS6	4.00	-.182	-.069	.655	.043	
	RDS7	4.13	-.522	-.195	.756	.050	
	RDS8	3.83	-.256	.022	.701	.049	

PROJECT TEAM COMMUNICATION PERFORMANCE INDICATORS (PCE) (FLOW & COMPOSITION)	*PCE1*	4.38	-.058	-.912	.544	.036	
	PCE2	3.93	-.234	-.602	.794	.052	
	PCE3	3.68	-.244	-.123	.576	.038	
	PCE4	4.24	-.319	-.800	.671	.044	
	PCE5	3.59	.038	-.370	.756	.050	
	PCE6	2.79	-.162	-.591	.874	.057	
	PCE7	4.05	-.716	.541	.769	.050	
	PCE8	3.84	.009	-.640	.738	.048	
	PCE9	2.23	.178	-.306	.760	.050	5.3299
	PCE10	3.86	-.213	-.153	.716	.047	
	PCE11	3.37	.225	-.597	.873	.057	
	PCE12	2.19	-.016	-.240	.614	.040	
	PCE13	2.20	.839	.673	.725	.048	
	PCE14	4.13	-.333	-.246	.684	.045	
	PCE15	3.94	-.523	.271	.796	.052	
	PCE16	4.14	.187	.438	.516	.034	

Source: Field Data (SD-Standard Deviation; SME-Standard mean Error)

The standard mean error of statistical data refers to the standard deviation of the sample mean and thus measures how representative a sample is likely to be to the population (Field, 2009). However, a large standard error compared to the sample mean suggests that there is a lot of variability between means of different samples whereas, a small standard error is an indication that most sample means are similar to the population mean (Field, 2009; Motulsky, 2005). This suggests that, the sample is likely to be an accurate reflection of the population (Field, 2009; Motulsky, 2005). From Table 7.1, the results of the standard mean error associated with all the means of the variables were less than 1.0 and very close to 0.00. This suggests that the sample chosen is an accurate reflection of the population.

Likewise, the standard deviations on a statistical data refer to the measure of consistency and variability associated with the interpretation of the variables by the respondents (Field, 2009). This is thus considered very critical towards statisitical reliability and trustworthiness of the data (Field, 2009; Motulsky, 2005). A small standard deviation (less than 1.00) associated with the mean scores of the variables/attributes being measured suggests a low variability and high consistency among the respondents in the interpretations of the variables (Field, 2009; Motulsky, 2005). A large standard deviation indicates a high variability and low consistency on the variables. Drawing on the results of the standard deviations associated with the variables in Table 7.1, it was detected that all the values were less than 1.00. This is an indication that the respondents accurately interpreted the variables and that there is little variability in the data and high consistency in agreement among the respondents. This gives credibility and truthworthiness to the results, interpretations and generalization in the study.

It is also affirmed that, the normality distribution characteristics of a sample data is measured by both univarate and multivariate normality test (Gao *et al.,* 2008; Kline, 2010; Lei and Lomax, 2005). The assessment of univarate normality of sample data is a description of the distribution of only one variable in the sample and thus considered very necessary but not sufficient condition for having multivariate normal distribution (Gao et al., 2008; Lei and Lomax, 2005). Multivarate normal distribution on the other hand, describes the joint distribution of all the variables contained in the sample (Gao *et al.,* 2008). The measure of the skweness, kurtosis and mardia's coefficient describes the univariate and multivariate normality of the data respectively (Kline, 2010; Gao *et al.,* 2008; Bentler, 2005). This thus significantly informs the most suitable model estimation approach to adopt to ensure unbiased standard errors in parameter estimates in the model (Kline, 2010; Gao *et al.,* 2008; Bentler, 2005).

From Table 7.1, it could be seen that the skewness values range from -.787 to .839 (.787≤ skewness ≤ .839). A normally skewed distributed sample has a skew value of zero (0.00) (Matulsky, 2005; Field, 2009). Similarly, the kurtosis values ranges from -.912 to 1.042 (-.912≤ kurtosis ≤1.042). The Absolute value for kurtosis for normal distribution sample is 3.0 (Field, 2009; Matulsky, 2005). From the univariate kurtosis values above, it could be seen that, these value fall short of the threshold value and as such the sample could thus be said to be kurtotic. Similarly, the mardia multivariate co-efficient were all below 3.0 except for one group. A study by Kaplan (2009) established that, when most of the mardia's coefficient of multivariate kurtosis lies in the range of -1.0 to +1.0, the statistical results of parameter estimates and standard error does not yield many distortions and thus the results are not unbias when maximum likelihood approach was adopted as the ME. From the univariate and multivariate normality results (mardia coeeficient) above, it could be suggested that the sample is slightly kurtotic and thus the data is slightly non-normal (Kline, 2010; Gao *et al.,* 2008; Bentler, 2005; Lei and Lomax, 2005).

According to Gao *et al.* (2008), when a data is non-normal, the estimation approach adopted must be more effective in dealing with the effects of non-normality as well as being helpful for improving the model than conducting transformation to deal with nonnormality. One other issue that is likely to affect the quality of SEM analysis, model fit results and trustworthiness of the model is the sample size (Kline, 2010; Iacobucci, 2010; Bollen *et al.*, 2007). It is argued that, SEM is a sample sentive analytical approach and results are highly reliable when sample size are large and normally distributed (Iacobucci, 2010; Bollen *et al.*, 2007; Byrne, 2006; Bentler, 2005). According to Iacobucci (2010), a sample size smaller than 100 is considered small and is more likely to produce estimates that are unstable except in extremely simple models.

Likewise, a sample size between 100-200 is considered a medium sample and thus considered very acceptable in model analysis but an appropriate estimation method and model must be selected (Kline, 2010; Bentler, 2005). Ultimately, a sample size greater than 200 is considered very large and most appropriate in SEM analysis (Iacobucci, 2010, Byrne, 2006; Bentler, 2005). However, it is sternly emphasized that, these do not represent the ideal approach to sample size suitability in SEM analysis. This is because even in large samples, unreliable standard errors could yield results that have the propensity to affect the quality of parameter estimates, standard errors and generate small model fit bias (Kline, 2010; Bentler, 2005; Iacobucci, 2010). This argument is underpinned by the fact that, issues such as commonality of variables (Cole *et al.*, 2007), the degree and kind of non-normality that may exist in the data (Boosma and Hoogland, 2001; Yuan and Bentler, 2001), the extent of missing data (Muthen and Muthen, 2002) and more specifically, the estimation method to be used (Iacobucci, 2010; Kline, 2010; Muthen and Muthen, 2002) affect the results and the degree of conclusions to be made.

Given that the sample size has been justified to be acceptable to yield unbiased results, improve accuracy on parameter estimates, the issue of the effect of the non-normality of the data must be dealt with (Hair *et al.*, 2013; Iacobucci, 2010; Bollen *et al.*, 2007; MacCallum *et al.*, 2006). According to Zhong and Yuan (2011), Kline (2010) and Bentler (2005), it has been impirically proven that adopting the most suitable estimation method approach equally deal with the data non-normality and yield acceptable estimates. Likewise, in deciding on the most suitable estimation method (approach) in the model evaluation and testing, it is thus important to draw on the nature and characteristics of the sample data (Boomsma and Hoogland, 2001).

Results of several studies generally indicated that it is extremely significant and best not to ignore the multivariate normality assumption in the data characteristics in the choice of the most effective estimation approach (see Hair *et al.*, 2013; Kaplan, 2009; Kline, 2010). Accordingly, Kline (2010), Hair *et al.* (2013 & 2014), Iacobucci (2010), Bollen *et al.* (2007), Roboust Maximum Likelihood (RML) is most suitable to yield robust standard results that are supposedly robust against the effect of non-normality on parameter estimates and give accurate results in SEM even in a minimum sample of 200 cases. Similarly, Henseler and Sarstedt (2013) also affirmed that, partial least squares (PLS) method is useful if the assumption of normality is not met in the data to be estimated.

However, Hair *et al.* (2014) and Wong (2011 & 2010) revealed that PLS method often produce bias estimates, highly succeptible to multicollinearity among variables and ineffective in reflective indicator factor construct in measurement models. Hence, by the theoretical and statistical import of this argument, as well as the reflective nature of the construct in the factors, the study adopted the robust maximum likelihood estimation method for the estimation and evaluation of the postulated model to suit the slightly nonnormality of the data (Iacobucci, 2010; Kline, 2010; Bollen *et al.*, 2007; Byrne, 2006). By following the recommendation from literature on RML estimation, the results are reported from robust statistics for the chi-square and establishing the factors scale by fixing the first item of each factor (Bentler, 2005; Bollen *et al.*, 2007; Hair *et al.*, 2013 & 2014).

7.2.3 Statistics on SEM Assumptions – Identifiability of the Model

Experts on SEM modeling emphasize the identifiability of the structural model as a further critical step and considered a requirement without a compromise (Kline, 2010; Bentler, 2005; Hair *et al.*, 2013). Hence, it is recommended that researchers must first, meticulously and statistically examine whether a model is theoretically identified or not order before a model can be accurately analyzed (Kline, 2010; Bentler, 2005). Kline (2010) and Kaplan (2009) suggested that, a model is said to be identified if it is theoretically possible to derive a unique estimate for each parameter contained in it.

Further to this, Kline (2010) and Lei and Wu (2008) consider a model identified when there are at least as many observations as free model parameters (namely, the degree of freedom ≥ 0) and that every unobserved variable must be assigned a scale. According to Byrne (2006), a model could also be identified as just-identified, over-identified or underidentified. The analysis of the identification of the model is crucial in deciding on the acceptance or the rejection of the model (Kline, 2010; Byrne, 2006). Byrne (2006) noted that, a model with more number of data variances and covariances of the observed variables than the number of parameters to be estimated resulting in a positive degree of freedom is said to be over estimated. They further indicated that an over-identified model has the number of parameters to be estimated being less than the number of data variances and covariances of the observed variables and therefore, results in a positive degree of freedom (Lei and Wu, 2008; Byrne, 2006). Hair *et al.* (2013) and Kline (2010) however, explained a just identified model as having equal number of parameters to be estimated as the number of covariances of the observed variables. They further explained that, under identified models are impossible to yield a solution. In SEM, models to be estimated are often conceptualized and expressed in graphical diagram showing the perceived relationship among the variables contained by connecting arrows between the exogenous (independent) variables and endogenous (dependent variables).

The conceptualized model as expressed in Figure 4.4 (see Chapter 4) indicates five (5) factor latent construct of unique features of mass housing projects as the exogenous variables and two (2) factor latent construct of communication performance indicators as the endogenous variables. The five factor latent construct predictors are hypothesized to be correlated and casualy related to the predictive two factor latent constructs of communication performance. By comparing to finding solutions to mathematical equations in algebra where the unknowns cannot be more than the known variables, in model identification and specification, it is theorized as a basic principle that, there cannot be a larger number of unknown parameters to be estimated than the number of unique pieces of information provided by the data (Hair *et al.*, 2013; Kline, 2010; Kaplan, 2009). Also in principle, experts of SEM analysis suggest that, due to the fact that the scale of a latent variable is arbitrary, another basic principle of identification is that, all latent variables must be scaled so that their values can be interpreted (Kline, 2010; Lei and Wu, 2008; Bentler, 2005).

Against this, it is suggested that a very good and identified model should exhibit positive degree of freedom for its parameters for over identified model (Lei and Wu, 2008; Bollen *et al.*, 2007; Bentler, 2005). This is beacause model identification allows for the inclusion and exclusion of variables in the model to yield the best results that adequately test the hypothesized model and theory (Kline, 2010; Lei and Wu, 2008). From the preliminary examination of the parameters through the comfirmatory factor analysis, the results of the EQS 6.2 softeware revealed a 6 and 120 minimum and maximum degrees of freedom respectively. This is an indication of a very good positive value of dgree of freedom and thus suggest iteratively that, the model is an over identified model. Hence, it can be said that the model under study can be estimated.

7.2.4 Confirmatory Factor Analysis of the Latent Constructs

Confirmatory factor analysis (CFA) is a statistical technique used to verify the factor structure of a set of observed variables especially in SEM measurement model (Kline, 2010; Lei and Wu, 2008). CFA is done by the researcher using knowledge of the theory, empirical research, or both, to postulate the relationship pattern a priori and then tests the hypothesis statistically by examining the variables measured or observed. Studies by Kline (2010), Byrne (2006) and Bentler (2005) stipulated that, assessment of the exogenous variables and endogenous variables as being sufficient indicators is very important towards assessing measurement invariance (MI). Against this, Byrne (2006) advised that, CFA must first be conducted on each of the latent constructs (variables) by assessing the coefficients and to reaffirm the factor structure of each construct so as to eliminate any possible measurement invariance that is likely to affect the good-fit of the model. Hence CFA was adopted to assess the fit of the items to the latent variables (inner models) contained because if the fit of each of these models is good and the item loading is acceptable, a more likely assumption that, the indicators underlying the factors are fitting the construct at hand in each of the latent constructs can be held without an error (Kline, 2010; Kaplan, 2009; Bollen *et al.*, 2007; Byrne, 2006). Likewise, the study adopted various model fit indexes to determine the goodness-of-fit of the model.

7.2.5 Fit Statistics on Inner Models (CFA)

Here, the study conducted Diagnostic Fit Analysis by using the Robust Maximum Likelihood, to test the Statistical Significance of Parameter Estimates and Internal Reliability and Validity of Scores on each of the Latent variables' factors (sub models or inner models) (Kline, 2010; Bollen *et al.*, 2007). The result is presented in the following sections.

7.2.5.1 Analysis of Multiple Construction Sites Management Style (MCS) Factor The Multiple Construction Site Management Style factor was defined by seven indicator variables (see Table 4.1 on page 130). The analysis proceeded to observe the factor structure, relevance of the indicator variables to the factor and the significance of the variables. A unidimensional analytical approach of the inner model for the MCS factor was conducted by using a total of 208 cases as the responses gathered during the survey data collection. A critical initial assessment of the responses revealed no missing data and thus the total 208 cases were used in the assessment of the inner model.

Following this, a preliminary confirmatory factor analysis was conducted on the full model (7 variables) for this construct. It is suggested that, researchers must critically assess all variables to decide on ones to be included in their sub models that adequately explains and measures a construct (Hair *et al.*, 2014, Wong, 2010; Bentler, 2005). In several studies, assessing of the correlations, standard errors, negative variance, communalities of the variables and unstandardized and standardized residual covariance matrix in a submodel and outer models are considered sufficient guidelines in selecting the most acceptable varaiables that should be contained in the construct for onward detailed analysis (Hair *et* *al.,* 2013; Field, 2009; Kaplan, 2009; Byrne, 2006; Bentler, 2005). However, in factor models and assessment of effects, extraction of variables in the factor (Communality) have been the dominant and increasingly accepted guide (see Hair *et al.,* 2014, Wong, 2010; Kline, 2010; Kaplan, 2009; Bentler, 2005). Hence, here communalities of the variables in the factor approach were used.

Extracted communalities should be above 0.5, with values above 0.7 being most acceptable (Kline, 2010; Field, 2009). Communalities less than 0.5 are thus considered inappropriate to the construct measures and are thus deleted or ignored from further critical analysis since their inclusion will affect the final results (Hair et al., 2014; Kline, 2010; Field, 2009; Lei and Wu, 2008). The results of the preliminary confirmatory factor analysis on the seven (7) variables that define the above construct were critically examined. This revealed that variables MCS3 (0.475), MCS5 (0.378) and MCS6 (0.448) with their communality values in brackets were all less than the conventional cut-off of 0.50 and were thus subsequently dropped and not considered for further detailed analysis.

The remaining four-indicator model variables (MCS1, MCS2, MCS4 & MCS7) with their communality scores above 0.50 provide good measure of the construct and evidence of convergent validity (Kline, 2010; Field, 2009; Bollen *et al.*, 2007). Subsequently, these four variables were subjected to detailed CFA analysis to confirm their model fit, goodness of fit, parameter extimation and statistical significance (Kline, 2010). The summary of variables that adequately define the construct is contained in Table 7.2 on page 212. In the view of Hair *et al.* (2014), Kilne (2010), Bollen *et al.* (2007) and Bentler (2005) to establish how well the model fit the sample data and the strength of the hypothesised relationship between the variables in a given construct, results of residual unstandardized and standardized covariance matrix, distribution of standardised residuals, fit statistics, internal consistency, score reliability and statistical significance at a probability level must be examined in the CFA analysis. In addition, the Cronbach's alpha and the Rho Coefficient of Internal Consistency were examined to determine the score reliability. The summary of these tests are presented in Table 7.2. They were then subjected to detailed CFA analysis for parameter estimates, significance, validity and model fit tests.

According to Lei and Wu (2008), Byrne (2006) and Bentler (2005), a properly and well specified structural equation model must have both fixed and free parameters to be estimated from the data. The Bentler week's score on the specified four variables defining the construct revealed that the *Multiple Construction Sites Management Style (MCS) factor* in the CFA analysis had 4 dependent variables, 5 independent variables, 5 free parameters as well as 5 fixed non-zero parameters. Hence, the results of the Bentler week's test suggest a well specified inner model. Likewise, in order for a sub-model to be

included in a detailed CFA Analysis, thus enabling the model to be described as wellfitting, the distribution of residuals covariance matrix should be symmetrical and centred around zero (Byrne, 2006; Boomsma and Hoogland, 2001). This is because, some solutions of perceived sound and fitting models may appear to be improper in the final model to be estimated hence it is extremely prudent for researchers to examine individual parameter estimates as well as their standard errors to curtail issues of multicollinearity and excessive correlations that affect the model results (Gao *et al.*, 2008; Lei and Wu, 2008; Bentler, 2005).

Table 7.2: Constructs and final Items: (Multiple Construction Sites & Management Style (MCS)

Code	Unstandardized Coefficient (λ)	Standardized Coefficient (λ)	Standard Error	Factor loadings	Z- value	R square	Sig-value	Remarks	Cronbach coefficient	Rho Coefficient
MCS1	0.884	0.651	0.095	0.651	9.305	0.526	.000		0.702	0.767
MCS2	0.802	0.845	0.079	0.845	10.152	0.764	.000			
MCS4	0.782	0.691	0.102	0.691	7.667	0.614	.000			
MCS7	0.563	0.532	0.083	0.532	6.783	0.429	.000			

Robust Fit Indexes for Multiple Construction Sites & Management Style (MCS) Factor

Fit Index	Cut-off value	Estimate		Remarks
S – Bχ^2		2.2311		
df	*x>0.00*	2		Acceptable fit
CFI	x≥0.90 (acceptable), x≥0.95 (good fit)	0.997		Good fit
GFI	x ≥ 0.90 (acceptable) x≥0.95 (good fit)	0.995		Good fit
SRMR	x≤ 0.08 (acceptable) x≤ 0.05 (good fit)	0.026		Good fit
RMSEA	x≤ 0.08 (acceptable) x≤ 0.05 (good fit)	0.024		Good fit
RMSEA 90% CI		0.000,	0.142	Acceptable fit
p-value	x≥ 0.05	0.33		Good fit

(Robust Statistical Significance at 5% level), *Parameter estimates are based on standardized solutions

Against this, the covariance residuals of the remaining four-indicator model were critically assessed to provide good measures of residual matrix and evidence of convergent validity. According to Bentler (2005) and Hair *et al.* (2013), good measures of of residual matrix and evidence of convergent validity should fall between -1.00 and +1.0 with values close to zero being good fit. Here, the average off-loading standardized and unstandardized residual covariance matrix realized from the RML CFA analysis (see appendix 1A), were 0.0109 and 0.0228 respectively, suggesting very close to 0.00 values and thus could be said to be a good fit.

From the perspective of Lei and Wu (2008) and Bentler (2005), once model parameters have been estimated, the researcher always wants to make an explicit dichotomous decision, either to retain or reject the hypothesized model. This is achieved by assessing whether the model under consideration fits the data or otherwise through hypothesis testing (Lei and Wu, 2005; Bentler, 2005). This is because when a model fits a data well and its solution is deemed proper, individual parameter estimates can be interpreted and examined for statistical significance, validity and reliability (Hair *et al.*, 2013; Lei and

Wu, 2008; Bentler, 2005). According to Hair et al. (2013), Kline (2010) and Byrne (2006), model fit assessment should use a multiple criteria of both incremental and absolute fit indices to supplement the chi-square test. Here in this study, a mix of comparative fit index (CFI) belonging to the incremental class of fit indices and goodness of fit (GFI), standardized root mean square (SRMS), residual mean-square error of approximation (RMSEA) also belonging to the absolute class of model fit assessment were used. The CFI has the advantage of reflecting fit at all sample sizes and measures the comparative reduction in noncentrality (Iacobucci, 2010; Lei and Wu, 2008; Bentler, 2005). This approach is influenced by the assertion that a multiple indices present a more robust approach to easily detect and negate bias associated with the use of a single index (Kline, 2010; Lei and Wu, 2008).

Also, even though in general, the Chi-sqaure test is considered as a good measure of fit, it is often inherently affected by sample size and consequently yields inaccurate probability values (Iacobucci, 2010; Byrne 2006). Hence, as a reaction to the sample size sensitivity of the chi-square, the Satorra-Bentler Scaled Chi-Square ($S - B\chi^2$) which is considered to offer a better fit result was used (Iacobucci, 2010; Kline, 2010; Kaplan, 2009). From Table 7.2, the CFI and the GFI yielded 0.997 and 0.995 respectively. According to Bentler (2005), CFI value of more than 0.90 is accepted as indications of good fit. Similarly, Iacobucci (2010) and Lei and Wu (2008) opined that a GFI test value of 0.90 and above is considered as acceptable good fit. Also, the SRMR and RMSEA values from Table 7.2 were 0.026 and 0.024 respectively. Bentler (2005) and Lei and Wu (2008) suggested that, an SRMR and RMSEA values less than 0.05 are considered good fit whereas values less than 0.08 are indicators of acceptable fit. Again, from the the results presented in Table 7.3, the sample data on MCS measurement model yielded an $S - B\chi^2$ of 2.311 with 6 degrees of freedom. The associated p-value was determined to be 0.330 with a normed value of 1.115.

According to Kline (2010) and Kaplan (2009), the overall goodness of fit is reflected by the magnitude of discrepancy between the sample covariance matrix and the covariance matrix (population) implied by the model such that good model fit must have degree of freedom (df) greater than 0 and p-values greater than 0.05. A p-value greater than 0.05 associated with the $S - B\chi^2$ indicate that, the difference between the sample data and the

MCS features model was insignificant and thus the model fits that data (Kline, 2010; Iacobucci, 2010; Kaplan, 2009; Byrne 2006). Hence they must be accepted and included in the full latent measurement model for the full analysis.

However, once a model null hypothesis is accepted, typically, it must be subjected to the assessment and interpretation of the relative size and significance levels of the parameter estimates towards indicating whether they differ significantly from zero as well as their reliability and internal consistencies (Kline, 2010; Kaplan, 2009; Bollen *et al.*, 2007). Hair et al. (2014), Kaplan (2009), Lei and Wu (2008) and Bentler (2005) suggested that tvalues or z- values and co-efficient of determination (R^2) values are useful in interpreting the significance and effects of the parameters in a model. The assessment of the reliability, validity and consistencies could be deduced from the Rho Coefficient, Cronbach Alpha and the factor loadings (Hair *et al.*, 2014; Kline, 2010; Iacobucci, 2010).

A critical assessment of the correlation values, standard errors and the test statistics (Zvalues) in Table 7.2 revealed that all correlation (coefficients) values were not greater than 1.00; *Z*-statistics were greater than 1.96 with positive signs and thus considered very appropriate. Hair *et al.* (2014) and Kaplan (2009) suggested that, the correlation values for parameter assessment lie between 0.00 and 1.00; with values closer to 1.0 being acceptable. By reporting the standardized parameter estimate as conventionally recommended in literature on SEM (see Hair *et al.*, 2014; Kline, 2010; Kaplan, 2009; Bentler, 2005), the Z-test statistics examined whether the path coefficients of the inner model are significant or not. According to Hair *et al.* (2014) and Kline (2010), by using a two-tailed Z-test with a significance level of 5%, the path coefficient will be significant if the Z-statistics is larger than 1.96. The results indicated that all the z-test values were greater than 1.96 and thus can be concluded that the indicator variables' loadings are highly significant in the model.

The Coefficient of determination (R^2) refers to the measure of the model's predictive accuracy. The measurement effect of the R^2 ranges from 0 to 1 with 1 representing complete predictive accuracy (Hair *et al.*, 2014; Kline, 2010). An R^2 value of 0.75 or more is described as substantial, 0.50 as moderate and 0.25 or less interpreted as weak levels of predictive accuracy (Hair *et al.*, 2014; Henseler *et al.*, 2010). From Table 7.2, it could be reported that, most of the coefficient of determination were above 0.5 and thus close to 1.0 except for MCS4, indicating that the factors explained more of the variance in the indicator variables. With these results, it can be concluded that the indicator variables significantly predict and define the unobserved construct. Hence the four measured variables are significantly associated with the MCS construct features.

Also, the Cronbach's alpha reported in Table 7.2 yielded 0.702. This value meets the recommended acceptable point of 0.700 (Hair *et al.*, 2014 & 2013) Similarly the Rho Coefficient yielded 0.767 which is also above the recommended 0.700 cut-off point (Hair *et al.*, 2014 & 2013). With both of these values being above 0.700, it could be said that the model has a good level of internal consistency and reliability, suggesting that the indicator variables correctly and adequately define the MCS features construct. All the factor loadings recorded in Table 7.2 were above 0.700. According to Kline (2010), Kaplan (2009) Iacobucci (2010) and Hair et al. (2013), adequate support is given for convergent validity in SEM analysis when each item has factor loadings above 0.70 and when each construct's average variance extracted (AVE) is 0.50 or higher. Hence a good convergent validity was met.

It could be remarked from the results in the CFA analysis that, the robust fit indexes and the residual covariance analysis met the recommened cut-off criteria and thus can be reported that, the model adequately fits the data. Subsequently, all the parameter estimates were also found to be statistically significant and feasible. Against this, the Multiple Construction Sites Management Style (MCS) features construct model was included in the final full outer model measuring the contribution of the unique features of mass housing to project team communication effectiveness (full latent variable model).

7.2.5.2 Analysis of Housing Unit Design and Contract Packaging (HDP) Factor This construct initially was explained by six indicator variables (see Table 4.0). A preliminary CFA analysis using the communalities extracted and variance to determine which variables are to be included in the CFA analysis to assess the fitting of the model was conducted. The preliminary CFA results revealed that variables HDP4 (0.425) and HDP6 (0.465) with their communality values in brackets were all less than the conventional cut-off of 0.50 and were thus subsequently dropped and not considered for further detailed analysis. The remaining four (4) variables having communalities above

0.5 were used in the subsequent detailed CFA analysis (Hair *et al.*, 2013; Kline, 2010; Field, 2009). The detailed analysis proceeded to observe the factor structure, relevance of the indicator variables to the factor, the significance of the variables, model fit and parameter estimation (Kline, 2010). The summary of variables that adequately define the construct is contained in Table 7.3.

Table 7.3: Constructs and final Items: Housing Unit Design Contract Packaging (HDP)

Code	Unstandardized Coefficient	Standardized Coefficient	Standard Error	Factor loadings	Z- value	R square	Sig-value	Remarks	Cronbach	Rho Coefficient (λ)
HDP1	0.947	0.801	0.086	0.801	11.011	0.642	0.000			
	0.606	0.608	0.072	0.608	8.417	0.460	0.002			
HDP2	0.563	0.683	0.055	0.683	10.236	0.594	0.000			
HDP3									0.684	0.721
HDP5	0.921	0.917	0.065	0.917	14.169	0.841	0.000			

Robust Fit Indexes for Housing Unit Design and Contract Packaging (HDP) Factor

Fit Index	Cut-off value	Estimate	Remarks
S – Bχ^2		18.467	
df	*x>0.00*	6	Acceptable fit
CFI	x≥0.90 (acceptable), x≥0.95 (good fit)	0.970	Good fit
GFI	x ≥ 0.90 (acceptable) x≥0.95 (good fit)	0.994	Good fit
SRMR	x≤ 0.08 (acceptable) x≤ 0.05 (good fit)	0.033	Good fit
RMSEA	x≤ 0.08 (acceptable) x≤ 0.05 (good fit)	0.030	Good fit
RMSEA 90% CI		0.000, 0.106	Acceptable fit

p-value	x≥ 0.05	0.305	Good fit

(Robust Statistical Significance at 5% level), *Parameter estimates are based on standardized solutions

The critical examination of the resultant Bentler-Weeks Structure Representation from the detailed CFA analysis revealed that the HDP factor has 4 dependant variables, 5 independent variables, 8 free parameters and 5 fixed non-zero parameters. This suggests that, the HDP factor model is well specified and identified (Kline, 2010; Bentler, 2005). Subsequently, the unstandardized and standardized average off-diagonal residual of Residual Covariance Matrix revealed 0.0182 and 0.0292 respectively. The result of standardized average off-diagonal residual being 0.0292 could be described as very close to 0.00 and thus suggestive of an acceptable and adequate fit to the sample data (Byrne, 2006)

From Table 7.3, the $S - B\chi^2$ yielded 20.036 with 6 degrees of freedom (df) and associeated probability of $p = 0.305$. Consequently, the normed Chi-square value $((S - B\chi 2)/df)$ was 3.077. Kline (2010) suggested that a normed value of 3.0 is considered good fit whereas that upto 5.0 is suggested as acceptable. Ideally, for a model that fits the data, the χ^2 or $S - B\chi^2$ would not be significant ($p>0.05$) (Kline, 2010; Iacobucci, 2010). Hence, it could be said that the $p = 0.305$ being greater than 0.05 indicate that the postulated model does not significantly differed from the sample data. Similarly, from the results on the Robust Fit Indexes for HDP Factor as reported in Table 7.3, the CFI was found to be 0.970 whereas the GFI was 0.994. These were found to be close to their conventional cutoff of $x \geq 0.90$ (acceptable) and $x \geq 0.95$ (good fit) and thus could be described as having a good fit (Kline, 2010). Also the RMSEA and SRMR yielded 0.030 and 0.033 respectively and thus the model could also be described as having a good fit because it meets the conventional cut-off values of $x \leq 0.080$ (acceptable) and $x \leq 0.05$ (good fit) (Kline, 2010;

Lei and Wu, 2008).

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The Cronbach's alpha and the Rho Coefficient were 0.684 and 7.21 respectively. The value of the Cronbach's alpha is slightly lower than the recommended acceptable point of 0.700 (Hair *et al.*, 2014; Iacobucci, 2010). However, Hair et al. (2014) further suggested that a value above 0.50 is also considered as acceptable. Additionally, the Rho Coefficient value of 0.721 is considered very good and thus could be deduced that the model is acceptable indicating a good internal-consistency, reliability and validity (Kline, 2010; Hair *et al.*, 2014). This suggests that the indicator variables correctly and adequately define the Housing Unit Design Contract Packaging (HDP) construct. Also, all the factor loadings recorded in Table 7.3 were above 0.700 and all the R^2 values were above 0.50 except for variables HDP2. This suggests adequate support for convergent validity and good average variance extracted (Hair *et al.*, 2014; Kline, 2010; Kaplan, 2009).

Lastly, the test of significance results revealed that all the Z-statistic values were greater than 1.96 with their corresponding significant test values being less than 0.05 ($p<0.05$) indicating statistically significance and acceptable results. In view of this, it could be deduced from the results of the CFA analysis that, the robust fit indexes and the residual covariance analysis met the recommened cut-off criteria and that the model adequatetly fits the data. Subsequently, all the parameter estimates were also found to be statistically significant and feasible. Therefore, the Housing Unit Design Contract Packaging (HDP) features construct model was included in the final outer model measuring the contribution of the unique features of mass housing to project team communication effectiveness (full latent variable model).

7.2.5.3 Analysis of Multiple Geographical Locations for Various Schemes (MGL) Factor

The Multiple Geographical Locations for Various Schemes (MGL) Factor construct was explained by four (4) indicator variables (Table 4.1). A preliminary CFA analysis conducted revealed that, all the four (4) variables' (see Appendix 1A) extracted communality values were more than the conventional cut-off of 0.50 and were thus subsequently considered for further detailed CFA analysis. The summary of results of the detailed CFA and the variables that adequately define the construct are contained in Table 7.4.

The MGL Factor construct was analysed using a total of 208 cases from the survey. The results from the Bentler-Weeks structure representation for the four (4) variables that passed the preliminary CFA test revealed that the MGL Factor has 4 dependent variables, 5 independent variables, 8 free parameters and 5 fixed non-zero parameters. This is an indication that the factor model for the MGL is well specified and identified (Bentler, 2005). In establishing how well the model fits the sample data and the strength of the hypothesised relationship between the variables and the factor, the results of unstandardized and standardized residual covariance distribution matrix, fit statistics and statistical significance at probability level of 5% were examined as well as the internal reliability and the validity (Kline, 2010; Iacobucci, 2010). From the results of the distribution of residuals in the covariance matrix in Appendix 1A, the unstandardized and standardized average off-diagonal residual were 0.0171 and 0.0286 respectively. The results yielded indicate that all the absolute residual values and the average off-diagonal absolute residual values were close to zero and thus could be described as being symmetrical and well-fitting (Kline, 2010; Byrne, 2006).

Table 7.4: Constructs and final Items: Multiple Geographical Location for Various Schemes (MGL)

Code	Unstandardized Coefficient	Standardized Coefficient (λ)	Standard Error	Factor loadings	Z- value	R square	Sig-value	Remarks	Cronbach Coefficient	Rho coefficient
MGL1	0.310	0.478	.046	.478	6.739	.228	.000			
MGL2	0.551	0.724	.054	.724	10.204	.524	.000		0.649	0.691
MGL3	0.191	0.230	.059	.230	3.241	.053	.000			
MGL4	0.467	0.663	.050	.663	9.343	.440	.000			

Robust Fit Indexes for Multiple Geographical Location for Various Schemes (MGL) Factor

Fit Index	Cut-off value	Estimate	Remarks
S – Bχ^2		3.9621	
df	*x>0.00*	2	Acceptable fit
CFI	x≥0.90 (acceptable), x≥0.95 (good fit)	0.983	Good fit
GFI	x ≥ 0.90 (acceptable) x≥0.95 (good fit)	0.992	Good fit
SRMR	x≤ 0.08 (acceptable) x≤ 0.05 (good fit)	0.028	Good fit
RMSEA	x≤ 0.08 (acceptable) x≤ 0.05 (good fit)	0.061	Acceptable fit
RMSEA 90% CI		(0.000, 0.163)	
p-value	x≥ 0.05	0.17	Good fit

(Robust Statistical Significance at 5% level), *Parameter estimates are based on standardized solutions

Additionally, the sample data on the MGL factor model yielded an $S - B\chi^2$ value of 3.9621 with 2 degrees of freedom (see Table 7.4). The associated *p*-value was also found to be 0.17. According to Kline (2010), a chi-square value greater than 0.05 (p-value >0.05) suggests that, the difference between the sample data and the postulated MGL factor model is insignificant and thus is an indication that the data fit the model well. It also suggests there is no discrepancy between between the sample and the population (Kline, 2010). The robust CFI and GFI indexes were 0.983 and 0.992 respectively. These results met the cut-off value of $x \geq 0.95$ and thus are indication of good fit (Kline, 2010; Iacobucci, 2010). Similarly, the SRMR and RMSEA met the cut-off values of 0.05 and 0.08 respectively. From this it could be suggested that the model adequately fits the data and thus considered a good fit.

Also, apart from the fit test analysis, the assessment of the parameter estimates, standard errors and test statistics are critical to determining whether the model worked properly and was feasible (Hair *et al.*, 2014 & 2013; Kline, 2010; Lei and Wu, 2008). Covariances or correlations greater than 1.00, negative variances and standard errors greater than 1.00 are considered unreasonable (Byrne, 2006). From Table 7.4, all standard errors were less than 1.00 and thus can be said to be reasonable and acceptable. Simiarly, the Z-test values were all greater than the recommended minimum cut-off value of 1.96 based on the probability level of 5% and their associated p-values less than 0.05. This is an indication that the variables were indeed statistically significant to the factor. The standardized parameter estimates (factor loadings) showed acceptable associations with the factor construct (Hair *et al.*, 2014; Kline, 2010).

Further to this, an examination of the predictive accuracy of the construct revealled that the R^2 values show substantial, moderate, or weak levels of predictive accuracy (Hair et al., 2011; Henseler et al., 2010). The variables MGL1 and MGL3 show less than 25% predictive accuracy whereas MGL2 and MGL4 account for over 50% varaance. The results therefore suggest that the indicator variables predict the factor construct considerably well. Additionally, the Cronbach's Alpha and the Rho Coefficient of internal consistency were examined for score reliability which was slightly below the recommended 0.7 coventional score. However, Hair *et al.* (2013) and Kline (2010) suggest that a score value of 0.5 is considered acceptable.

From the CFA output results, the compelling observation from the residual covariance estimates shows acceptable results in congruence with conventional limits. Also, the robust fit indexes met the cut-off index criteria, as well as the parameter estimates yielding statistically significant and feasible scores. It can thus be summarized therefore that, the factor model for the Multiple Geographical Location for Various Schemes, had an adequate fit to the sample data and thus should be included in the full model for further analysis.

7.2.5.4 Analysis of Complex Network of Procurement Systems (NPS) Factor

The results of the communalities extracted from the initial six (6) variables defining the factor from the preliminary CFA test revealed that, two of the variables (NPS1 & NPS3) were below the coventional acceptable limit of 0.5 and were thus subsequently dropped and not included for the further detailed CFA analysis. This meant that only four variables (NPS2, NPS4, NPS5 & NPS6) were found to meet the conventional acceptable level of communalities and thus accepted for further CFA analysis to assess the factor structure, score reliability, statistics test and goodness of fit of the factor (Hair *et al.*, 2014; Kline, 2010). From the Bentler-Weeks structure results, there were 4 dependent variables, 5 independent variables, 8 free parameters and 5 fixed non-zero parameters suggesting a well specified model (Bentler, 2005). Hence the model was then subjected to detailed CFA analysis.

The results of the detailed CFA analysis are presented in Table 7.5. The unstandardized average off-diagonal residual was 0.0035 whereas the standardized average off-diagonal residual registered 0.0076 (see Appendix 1A). These results of the model in the residual covariance matrix can be described as being well-fitting due to the distribution of standardised residuals being symmetrical and centred around zero (Kaplan, 2009; Byrne, 2006). Consequently, the sample data on NPS model yielded an $S - B\chi^2$ of 9.351 with 2 degrees of freedom and an associated *p*-value of 0.0839 for the analysed sample of 208 cases. Ideally, for a model that fits the data, the χ^2 or $S - B\chi^2$ would not be significant ($p>0.05$) (Iacobucci, 2010; Bentler, 2005). This is an indication that the chi-square value being greater than 0.05 suggests that the difference between the sample data and the postulated NPS factor model was not significant. Hence, it can be concluded that there is no significant difference and discrepancy between the sample data and the population and thus the fit function is good and well specified leading to retaining the model (Kline, 2010). Additionally, the ratio of $S - B\chi^2$ to the degrees of freedom (normed chi-spquare) was determined to be 4.675, which was lower than the upper limit value of 5.0 and thus described as an acceptable fit (Kline, 2010; Iacobucci, 2010).

Table 7.5: Constructs and final Items: (Complex Network of Procurement Systems (NPS))

Code	Unstandardized Coefficient (λ)	Standardized Coefficient (λ)	Standard Error	Factor loadings	Z- value	R square	Sig-value	Remarks	Cronbach coefficient	Rho Coefficient
NPS 2	0.654	0.674	0.045	0.674	14.533	0.646	0.000		0.705	0.723
NPS 4	0.552	0.503	0.048	0.503	11.501	0.352	0.000			
NPS 5	0.644	0.642	0.044	0.642	14.591	0.672	0.000			
NPS 6	0.632	0.514	0.051	0.514	12.392	0.504	0.000			

Robust Fit Indexes for Complex Network of Procurement Systems/Subcontracting (NPS)

Fit Index	Cut-off value	Estimate	Remarks
S – Bχ^2		9.3512	
df	*x>0.00*	2	Acceptable fit
CFI	x≥0.90 (acceptable), x≥0.95 (good fit)	0.998	Good fit
GFI	x ≥ 0.90 (acceptable) x≥0.95 (good fit)	0.998	Good fit
SRMR	x≤ 0.08 (acceptable) x≤ 0.05 (good fit)	0.008	Good fit
RMSEA	x≤ 0.08 (acceptable) x≤ 0.05 (good fit)	0.002	Good fit
RMSEA 90% CI		(0.000, 0.078)	Good fit

p-value	$x \geq 0.05$	0.839	Good fit

(Robust Statistical Significance at 5% level), *Parameter estimates are based on standardized solutions

Also, from Table 7.5, the robust GFI and CFI Indexes were both 0.998 which are said to be very close to the upper limit value of 1.00. A model is described as a good fit when the CFI and GFI are above the cut-off value of 0.95 (Iacobucci, 2010; Kline, 2010; Bentler, 2005). Similarly, a very good fit model will have the RMSEA and SRMR values up to 0.05. The results in Table 7.5 were 0.002 and 0.008 respectively. With the acceptable values of SRMR and RMSEA, there is an indication of a good fitting model for the NPS factor. Furthermore, from the results in Table 7.5, the Z- test statistics were all greater than the minimum threshold of 1.96 and their accompanying probability level at 5% were all significant (Hair *et al.,* 2014; Kline, 2010; Iacobucci, 2010; Byrne, 2006**).** Hence with the standardized coefficient values yielded being less than 1.00 as well as the Z- test statistics being statistically significant, it can be concluded that the estimates are reasonable and appropriate for the model NPS Factor.

Also the factor loadings were above the minimum value of 0.5 indicating that the results are good indicators of construct validity (Hair et al., 2014; Iacobucci, 2010; Bentler, 2005). Kline (2010) and Bentler (2005) suggested that, support is provided for convergent construct validity when each item has outer factor loadings above 0.70 and when each construct's average variance extracted (AVE) is 0.50 or higher. Hence it can be expressed succinctly that, an AVE of 0.50 shows that the construct explains more than half of the variance of its indicators. The R^2 values were all greater than 0.50. This means that the variance extracted for each of the variables in the construct exceeded the suggested threshold of 0.50, indicating that the variance captured by a variable was larger than the variance due to measurement errors (Hair *et al.*, 2014 & 2013; Kline, 2010). Hence, the overall results suggest that, the indicator variables adequately and considerably predict the factor construct.

Additionally, the Cronbach's alpha and Rho Coefficients for the construct were found to be 0.705 and 0.723 respectively. With both values being greater than 0.7, it is an indication of a high level of internal consistency and reliability in the factor construct (Hair *et al.*, 2014; Kline, 2010). Hence, it can be deduced that with the residual covariance estimates falling within the acceptable range; the robust fit indexes having a good fit, as well as all parameter estimates being statistically significant and feasible, the Complex Network of Procurement Systems (NPS) factor can be said to have a good fit and thus acceptable for inclusion in the full model.

7.2.5.5 Analysis of Repetitive Tasks Management Delivery Strategy (RDS) Factor The Repetitive Task Management Delivery Strategy factor was defined by eight (8) variables (see Table 4.1). From the results of the communalities extracted from the preliminary CFA test, three of the variables (RDS1, RDS5 & RDS8) were found to have their communalities below the coventional acceptable limit of of 0.5 and were thus subsequently droped and not included for further detailed CFA analysis (Field, 2009). This meant that only five variables (RDS2, RDS3, RDS4, RDS6 & RDS7) were found to meet the conventional acceptable level of communalities and thus were consequently accepted for further CFA analysis. From the Bentler-Weeks structure representation for the accepted five (5) indicator RDS factor, there were 5 dependent variables, 6 independent variables, 10 free parameters and 6 fixed non-zero parameters printed. This suggests that the sub-model is well specified (Bentler, 2005).

Table 7.6: Constructs and final Items: (Repetitive Tasks Management on Housing Units & Delivery Strategy (RDS) Factor)

Code	Unstandardized Coefficient (λ)	Standardized Coefficient (λ)	Standard Error	Factor loadings	Z- value	R square	Sig-value	Remarks	Cronbach coefficient	Rho Coefficient
RDS2	0.650	0.690	0.046	0.690	14.125	0.524	0.000			
RDS3	0.753	0.704	0.052	0.704	14.481	0.546	0.010		0.709	0.833
RDS4	0.562	0.533	0.060	0.533	9.367	0.301	0.000			
RDS6	0.696	0.672	0.055	0.672	12.655	0.500	0.002			
RDS7	0.792	0.763	0.048	0.763	16.496	0.645	0.000			

Robust Fit Indexes for Repetitive Tasks Management On Housing Units & Delivery Strategy (RDS)

Fit Index	Cut-off value	Estimate	Remarks
S – Bχ^2		12.283	
df	*x>0.00*	4	Acceptable fit
CFI	x≥0.90 (acceptable), x≥0.95 (good fit)	0.993	Good fit
GFI	x≥ 0.90 (acceptable) x≥0.95 (good fit)	0.990	Good fit
SRMR	x≤ 0.08 (acceptable) x≤ 0.05 (good fit)	0.035	Good fit
RMSEA	x≤ 0.08 (acceptable) x≤ 0.05 (good fit)	0.020	Good fit

RMSEA 90% CI		(0.000, 0.101)	Acceptable fit
p-value	x≥ 0.05	0.360	Good fit

(Robust Statistical Significance at 5% level), *Parameter estimates are based on standardized solutions

In establishing how well the RDS factor model fit the sample data and the strength of the hypothesised relationship between the variables, the results of residual covariance distribution matrix (unstandardized and standardized), fit statistics and statistical significance, the Cronbach's Alpha and the Rho Coefficient were examined for score reliability. This result is presented in Table 7.6. From results of the detailed CFA, the unstandardized average off-diagonal residual was 0.0145, while the standardized average off-diagonal residual was found to be 0. 0291 (see Appendix 1A). This results suggest that, all the absolute residual values and the average off-diagonal absolute residual values were close to zero and thus considered as well fitting because the distribution of standardised residuals are symmetrical and centred around zero (Byrne, 2006; Bentler, 2005). This affirms that the model had a good-fit to the sample data and thus a further test of goodness-of-fit is justified.

In the assessment of the goodness of fit, the sample data for the RDS Factor yielded an S – Bχ^2 of 12.283 with 4 degrees of freedom and associated probability of 0.360 ($p \geq 0.05$) (see Table 7.6). This value of Satorra chi-square and its associated p-value suggests that the difference between the sample data and the postulated RDS Factor model was insignificant. Additionally, the ratio of $S - B\chi 2$ to the degrees of freedom was determined to be 3.071 which was lower than the conventional upper limit value of 5.0 (Kline, 2010; Kaplan, 2009). Subsequently, the robust GFI of 0.990 and CFI of 0.993 were deemed good fit as they are all within the acceptable range. The the robust SRMR value of 0.035 and RMESA of 0.020 were also conventionally acceptable and thus is an absolute indication of a good fit of the model to the sample.

Ideally, a fitting model must have significant parameter estimates especially in the Z-test to aid in determining whether the factor structure worked properly and also feasible (Kline, 2010; Byrne, 2006). From Table 7.6, it can be reported that the test statistics were all greater than the conventional minimum acceptable limit of 1.96 and their associated sig.-values were less than 0.05 (Kline, 2010; Byrne, 2006). This suggests that, the estimates yielded were indeed reasonable as well as statistically significant (Byrne, 2006; Kline, 2010; Iacobucci, 2010). Additionally, the R^2 values were all found to be close to the desired value of 1.00 indicating that the factors explained more of the variance in the indicator variables except for RDS4. This is an indication that, all other variables account for more than 50% predictive accuracy of the construct whereas RDS4 accounts for slightly above 25%.

The Rho Coefficient and the Cronbach's Alpha coefficient were 0.833 and 0.709 respectively (see Table 7.6). These values are higher than the generally accepted limit of 0.7 and thus could be said that, the RDS factor satisfied both internal reliability and the construct validity criteria. In all, the total assessment of the RDS factor revealed that, the residual covariance estimates fell within the acceptable range; the robust fit indexes had a good fit; all parameter estimates were statistically significant and feasible. Hence, the RDS factor had a good fit to the sample data and thus accepted for inclusion in the full model.

7.2.5.6 **Project Team Communication Effectiveness Measurement Factors**

The assessment of the Project Team Communication Effectiveness was undertaken by operationalized sixteen (16) variables (see Table 4.1). This was conceived as the endogenous (Dependent Variable-Factor) in this study. As indicated by Xie (2002) and Xie *et al.* (2010), the induced communication ineffectiveness experienced among the project team on construction projects are perceived in the flow of the information and the composition of the information. By drawing on the theoretical perspective of this study (see Chapter 3), the analysis of the communication effectivness among the mass housing project team was conceived in two main dimensions as in the flow of the information and the composition of the information.

Here the Project Team Communication ineffectivess associated with the flow of information factors were defined by seven (7) indicator variables whiles that associated with the composition of the information factor was defined by nine (9) variables (see Table 4.1). The analysis of these factors defining the project team communication ineffectiveness construct is presented in the proceeding section.

Analysis of Project Team Communication Performance Effectiveness (PCE) Outcome Factor (Information Flow)-Endogenous Factor

The initial preliminary CFA analysis conducted on the seven (7) variables defining the Project Team Communication ineffectiveness associated with information flow revealed that, only four variables had communalities above the convential acceptable minimum limit of 0.5 (Hair et al., 2014; Kline, 2010; Field, 2009). These variables were PCE3, PCE7, PCE13 & PCE14. The variables PCE 10, PCE12 and PCE 15 had extracted communnalities to be less than 0.5 and were subsequently dropped from the model for further analysis. The accepted variables were then subject to detailed CFA analysis

(Wong, 2011; Kline, 2010; Byrne, 2006).
The examination of the Bentler-Weeks structure representation for the accepted four (4) indicator factors indicated 4 dependent variables, 5 independent variables, 8 free parameters

and 5 fixed non-zero parameters from the detailed CFA analysis. This is an indication that the sub-model is well specified (Bentler, 2005). Also, it is posited that, a good and well fitting model should have absolute residual values and the average offdiagonal absolute residuals for both unstandardized and standardized very close to or centered around zero (Kline, 2010; MacCallum *et al.*, 2006; Byrne, 2006). The unstandardized average off-diagonal residual was 0.0091, while the standardized average off-diagonal residual was found to be 0.0244 (see Appendix 1A). These values can be said to be very close to 0.00 and therefore suggest that, the model has an adequate fit to the sample data. Consequently, the robust fit indexes on the PCE Outcome factor (Information Flow) yielded $S - B\chi^2$ of 20.054 with 6 degrees of freedom and the associated associated probability of 0.480 ($p \geq 0.05$) (see Table 7.7). This result reveals that the Satorra chi-square was insignificant and thus an indication that, the sample data adequately fit the data and indicative of an acceptable fit (Kline, 2010; Iacobucci, 2010). Additonally, the mormed chi-square which is the ratio of the chi-square to the degrees of freedom was found to be 3.342. This ratio was lower than the upper limit of 5.0 (Kline, 2010; MacCallum *et al.*, 2006; Bentler, 2005). Hence, the factor model was therefore considered to be of an acceptable fit.

The robust GFI and CFI indexes yielded 0.999 and 0.997 respectively meeting the conventional cut-off of 0.95 and thus suggesting a good fit. The SRMR and MMSEA values of 0.024 and 0.001 respectively were good fit results since they were less than 0.05 (see Table 7.7) (Kline, 2010; MacCallum *et al.*, 2006).

Table 7.7: Constructs and final Items: (Project Team Communication Performance Effectiveness (PCE) Outcome Factor (Information Flow)-Endogenous Factor)

Code Unstandardized Standardized Standard Factor Z- value R square Sig-value Remarks Cronbach Rho Coefficient (λ) Coefficient (λ) Error loadings coefficient Coefficient

PCE3	0.662	0.691	.058	0.586	11.414	0.478	.000	0.711	0.836
PCE7	0.873	0.806	.043	0.806	20.302	0.650	.000		
PCE13	0.869	0.783	.047	0.783	18.489	0.613	.000		
PCE14	0.873	0.806	.043	0.806	20.302	0.650	.000		

Robust Fit Indexes for Project Team Communication Performance Effectiveness (PCE) Outcome Factor (Information Flow)-Endogenous Factor

Fit Index	Cut-off value	Estimate	Remarks
S – Bχ^2		20.054	
df	*x>0.00*	6	Acceptable fit
CFI	x≥0.90 (acceptable), x≥0.95 (good fit)	0.999	Good fit
GFI	x ≥ 0.90 (acceptable) x≥0.95 (good fit)	0.997	Good fit
SRMR	x≤ 0.08 (acceptable) x≤ 0.05 (good fit)	0.024	Good fit
RMSEA	x≤ 0.08 (acceptable) x≤ 0.05 (good fit)	0.001	Good fit

RMSEA 90% CI		(0.000, 0.125)	Acceptable fit
p-value	x≥ 0.05	0.480	Good fit

(Robust Statistical Significance at 5% level), *Parameter estimates are based on standardized solutions

Additionally, the assessment of standard errors and the test statistics (see Table 7.7) revealed that, all Z-values were greater than the cut-off value of 1.96 and were significant as well as with acceptable standard error margins (less than 1.0). Also, all parameter estimates greater than 0.5 which is an indication that, the variables were found to be more associated with the PCE Outcome factor (Information Flow).

In addition, the R^2 values were also found to be greater than the normally accepted minimum of 0.700 (Hair *et al.*, 2014) except for PCE3. Hence it can be said that, the factor adequately explain and predict the variance in the indicator variables. However, with PCE3 accounting for about 25% (0.478) variance could also be seen as acceptable (Hair *et al.*, 2014; Iacobucci, 2010). The results therefore suggest that, the indicator variables significantly predict the factor construct as almost all the variables are significantly associated with Project Team Communication Performance Effectiveness (PCE) Outcome Factor (Information Flow). Also, the Rho Coefficient and the Cronbach's Alpha Coefficient revealed 0.836 and 0.711 respectively which were higher the recommended acceptable value of 0.7 (Hair *et al.*, 2014; Kline, 2010; Byrne, 2006). This suggests a high degree of internal consistency and homogeneity (see Table 7.7). Against this, it can be concluded that, the assessment of the PCE information flow outcome factor indicate an adequate fit for the sample data and the parameter estimates. Likewise, the test statistics yielded satisfactory results at 5% level. Hence the factor model was accepted for inclusion in the full latent model.

Analysis of Project Team Communication Performance Effectiveness (PCE) Outcome Factor (Information Composition)-Endogenous Factor

The initial preliminary CFA conducted on the factor involving all the nine (9) variables revealed that five variables (PCE2, PCE5, PCE6, PCE8 & PCE16) had their extracted communialities above the conventional minimum point of 0.5 (Field, 2009). The variables PCE1, PCE4, PCE11 & PCE9 all had their communalities below the recommended 0.5 value and were subsequently droped from the factor for further CFA analysis (Field, 2009, Wong, 2011). Project Team Communication Performance Effectiveness (PCE) Outcome Factor (Information Composition) construct was further subjected to detailed CFA analysis to determine the acceptance or otherwise of the construct into the full model. Examination of the Bentler-Weeks structure representation for the five variables adopted from the preliminary CFA test revealed 5 dependent variables, 6 independent variables, 10 free parameters and 6 fixed non-zero parameter for the PCE Outcome factor (Information Composition) construct. The presence of some fixed parameters and some free parameters to be estimated from the data is an indication that the sub model is well specified (Kline, 2010; Bollen *et al.*, 2007; Bentler, 2005). Hence, the model was subsequently subjected to detailed CFA analysis (Kline, 2010; Byrne, 2006).

From the detailed CFA analysis, the results of the residual covariance matrix distribution (see Appendix 1A) revealed the unstandardized average off-diagonal residual as 0.0137, while the standardized average off-diagonal residual was found to be 0.0274. It is well affirmed that, for a well-fitting model, the distribution of standardised residuals should be symmetrical and centred around zero (Byrne, 2006). From the results, all the absolute residual values and the average off-diagonal absolute residual values were deemed close to zero and as such the Information Composition PCE Factor can be described as well

fitting.

Additionally, the robust fit test presented in Table 7.8, revealed the S – Bχ^2 as 11.9693 with 9 degrees of freedom with an associated p-value of 0.190 for the analysed sample of 208 cases. From this, it can be suggested that, the difference between the sample data and the postulated PCE Information Composition Factor model was insignificant and thus the data adequately fit the model (Hair *et al.,* 2014; Kline, 2010; Kaplan, 2009). Also, the robust GFI, SRMR and RMSEA were all found to meet the good fit threshold (see Table 7.8). However, the robust CFI index of 0.874 was found to be slightly less than the cut-off value for a good fitting model. Hence by drawing on the SRMR, GFI and the RMSEA good fit results, the model was subsequently accepted to have sufficient fit.

From the results in Table 7.8, the Z-test statistics were all found to be greater than the minimum threshold of 1.96 at a probability level of 5% and their associated sig-values were all significant (Byrne, 2006). The standard errors were also acceptable as none were negative and greater than 1.0. Also, all standardized parameter estimates (factor loadings) showed high associations (0.7 and above) suggesting an acceptable level of convergent validity (Hair et al., 2014; Kline, 2010). In addition, R^2 values which examines the degree of predictive accuracy between the factor construct and the indicator variables were found to be above 0.7 and close to the desired value of 1.00 as perfect prediction (Hair *et al.*, 2014; Kaplan, 2009; Henseler *et al.,* 2009). All variables except for variable PCE2 had their R^2

above the conventional 0.7. The variable PCE2 had it R^2 above 0.5 which is also considered an acceptable moderate level of predictive accuracy (Hair *et al.*, 2014; Iacobucci, 2010; Henseler *et al.*, 2009).

Table 7.8: Constructs and final Items: (Project Team Communication Performance Effectiveness (PCE) Outcome Factor (Information Composition)-Endogenous Factor)

Code	Unstandardized Coefficient (λ)	Standardized Coefficient (λ)	Standard Error	Factor loadings	Z- value	R square	Sig-value	Remarks	Cronbach coefficient	Rho
PCE2	0.823	0.720	.083	0.720	9.916	0.561	0.000		0.842	0.898
PCE5	0.803	0.904	.049	0.904	16.390	0.821	0.008			
PCE 6	0.772	0.871	.067	0.871	11.443	0.786	0.000			
PCE8	0.825	0.866	.080	0.866	10.301	0.701	0.000			
PCE16	0.837	0.945	.034	0.945	24.611	0.856	0.000			

Robust Fit Indexes for Project Team Communication Performance Effectiveness (PCE) Outcome Factor (Information Composition)-Endogenous Factor

Fit Index	Cut-off value	Estimate	Remarks
S – Bχ^2		11.9693	
df	*x>0.00*	9	Acceptable fit
CFI	x≥0.90 (acceptable), x≥0.95 (good fit)	.874	Acceptable fit
GFI	x ≥ 0.90 (acceptable) x≥0.95 (good fit)	.981	Good fit
SRMR	x≤ 0.08 (acceptable) x≤ 0.05 (good fit)	.048	Good fit
RMSEA	x≤ 0.08 (acceptable) x≤ 0.05 (good fit)	.043	Good fit

RMSEA 90% CI		(0.000, 0.095)	Acceptable fit
p-value	x≥ 0.05	0.19	Good fit

(Robust Statistical Significance at 5% level), *Parameter estimates are based on standardized solutions

The results therefore suggest that the indicator variables predict the factor construct adequately. Also, the Rho Coefficient and the Cronbach's Alpha coefficient being 0.898 and 0.842 respectively which are above the 0.7 conventional desired level are indication of acceptable level of internal consistencies and reliability (Hair *et al.*, 2014; Kline, 2010; Iacobucci, 2010; Byrne, 2006).

From the CFA test presented, it could be deduced that the residual covariance estimates, and the robust fit indexes met the cut-off index criteria and also the parameter estimates yielded reasonable, feasible and statistically significant results. Hence the Project Team Communication Performance Effectiveness (PCE) Factor (Information Composition) construct model had an adequate fit to the sample data and was indeed accepted for inclusion into the full latent model.

Hence the specified full latent model containing the variables and their parameter estimates investigating the contribution of the unique features of mass housing projects on project team communication performance can be summarized in Table 7.9.

Table 7.9: Summary of Final Items Defining the Factors in the final specified full latent model (Constructs)

Code	Final Items Definining the Factors	Factor Loadings	Z-Values	R Square	Cronbach's Alpha (Rho Coefficient)
	Multiple Construction Sites Management Style (MCS) (Exogenous Factor)				
					MCS1 __Contractor management adopted on
	Site management style adopted on the housing units under scheme	0.845	10.152	0.764	
	Change orders (Variation Orders) procedures adopted on repetitive housing units under scheme	0.691	7.667	0.614	
style housing units under scheme	0.651	9.305	0.526		
MCS20.702 (0.767)					
MCS4					
MCS7	Quality Management style and approach adopted on housing units and overall scheme(s)	0.532	6.783	0.429	
	Housing Unit Design Contract Packaging (HDP) (Exogenous Factor)				
HDP1	Composition of housing design in each contract packages under housing scheme	0.801	11.011	0.642	0.684 (0.702)
HDP2	Construction elements and components adopted in design units in contract packages under scheme	0.608	9.806	0.460	
HDP3	Packaging of 'one-off' infrastructure. e.g water, electricity, road etc on housing units under scheme	0.683	12.055	0.594	
HDP5	ndardised repetitive housing units under scheme	0.917	14.169	0.841	
	Multiple Geographical Location for Various Schemes (MGL) Factor (Exogenous Factor)				
MGL4	Geographical constraints and challenges due to location influence on repetitive works and housing delivery	0.663	9.343	0.440	
	Complex Network of Procurement Systems (NPS) (Exogenous Factor)				

NPS 2	Project team composition adopted on the housing scheme under management (eg. only in-house team or inhouse and external professionals (mixed) Packaging of 'Preliminaries items' adopted under sta	0.674	14.533	0.646	0.705 (0.723)
MGL1	Influence of Local Development Controls across different geographical locations on housing units under scheme	0.478	6.739	0.228	0.649 (0.691)
MGL2	Cultural influence within labour work force due to geographical locations	0.724	10.204	0.524	
MGL3	Influence of customary laws and practices on the tennural lands under scheme in various geographical locations	0.230	3.241	0.053	
NPS 4	Subcontracting style adopted across housing units under scheme	0.503	11.501	0.352	
NPS 5	Control, monitoring and coordination style in subcontracting on housing units under housing scheme	0.642	14.591	0.672	
NPS 6	Prospective Buyer' involvement in the construction process under scheme	0.514	12.392	0.504	

Table 7.9 Cont'd

Code	Final Items Definining the Factors	Factor Loadings	Z-Values	R Square	Cronbach's Alpha (Rho Coefficient)
	Repetitive Tasks Management Delivery Strategy (RDS)				

RDS2	Cost saving management techniques adopted for standardised repetitive construction works on housing units under scheme	0.690	14.125	0.524	
RDS3	Project delivery times adopted for various housing units under the scheme	0.704	14.481	0.546	0.709 (0.833)
RDS4	Repetitive Task delivery scheduling concept adopted on various housing units	0.533	9.367	0.301	
RDS6	Reporting styles adopted for Project Team (PT) communication	0.672	12.655	0.500	
PCE3	Receiving less information than expected from team participants for tasks	0.691	11.414	0.478	
PCE7	Late delivery of needed communicated information	0.806	20.302	0.650	
PCE13	Difficulty in disseminating information among project team	0.783	18.489	0.613	
RDS7	Dissemination protocols adopted for Project Team (PT) communication	0.763	16.496	0.645	
	(Project Team Communication Performance Effectiveness (PCE) Outcome Factor (Information Flow)-(Endogenous Factor)				
					0.711 (0.836)
PCE14	Difficulty in accessing communicated information from channels	0.806	20.302	0.650	
	Project Team Communication Performance Effectiveness (PCE) Outcome Factor (Information Composition)-(Endogenous Factor)				
PCE2	Lack of consistency in communicated information leading to lack of coordination among project team	0.720	9.916	0.561	
PCE5	Receiving conflicting information from team participants	0.904	16.390	0.821	
PCE6	Lack of clarity in communicated information resulting in different interpretations	0.871	11.443	0.786	
PCE8	Misunderstanding of communicated information	0.866	10.301	0.701	0.842 (0.898)
PCE16	Lack of defined roles and responsibilities among members of the team leading to communication failure	0.945	24.611	0.856	

7.2.6 Hypothesized Relationship for the Evaluative Communication Structural Model

The hypothesized model (Figure 7.1), in which final items defines the main factors (features) (Multiple Construction Sites Management Style (MCS), Housing Unit Design Contract Packaging (HDP), Multiple Geographical Location for Various Schemes (MGL), Complex Network of Procurement Systems (NPS), Repetitive Tasks Management Delivery Strategy (RDS)) that contribute to the project team communication ineffectiveness on mass housing in terms of information flow and information composition was tested.

The hypothesized model being tested is premised on the fact that the occurrence of communication ineffectiveness among the project team on mass housing project relating to information flow and information composition are inherent in the significance influence of the unique features of MHPs. This hypothesized relationship is diagrammatically represented in Figure 7.1. The specified model in Figure 7.1 was fitted to the data for the entire sample as a conventional requirement in SEM analysis (Kline, 2010; Byrne, 2006; Bentler, 2005).

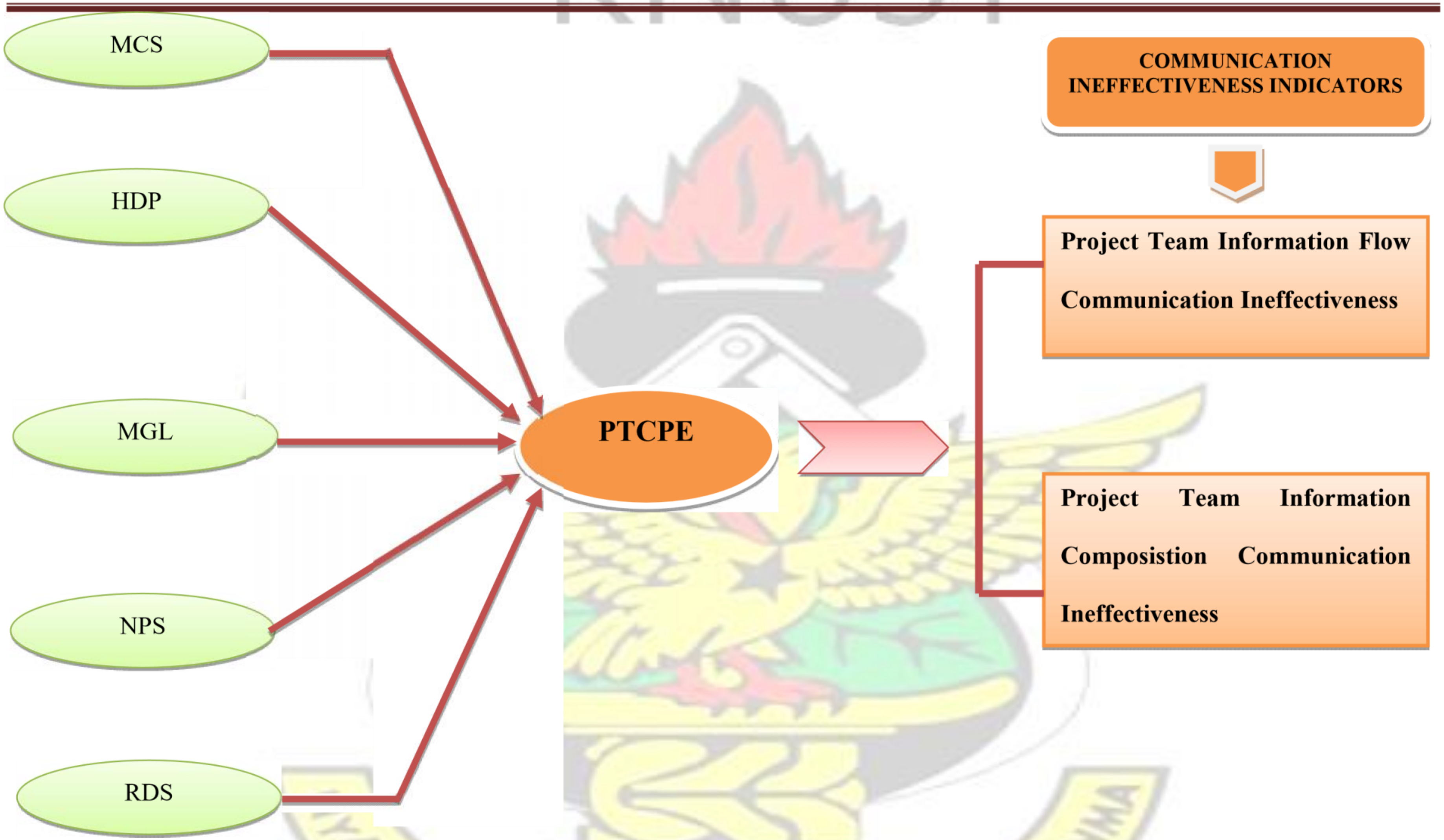

MCS
HDP
MGL
NPS
RDS
PTCPE
COMMUNICATION INEFFECTIVENESS INDICATORS
Project Team Information Flow Communication Ineffectiveness
Project Team Information Composistion Communication Ineffectiveness

Figure 7.1: Hypothesized Evaluative Model of Mass Housing Project Team Communication Effectiveness (Model 1.0)

7.2.7 Model Estimation

The two main six (6) factor models each assessing the contribution of the unique features of mass housing to project team communication ineffectiveness in relation to information flow and information composition respectively were fitted to the data using the Robust Maximum Likelihood (RML) estimation method. The justification for the choice of RML had been given in section 7.2.2. Consequently, in line with conventional requirements in SEM, by using the RML method, the robust statistics were reported in ascertaining the fit of the model (Kline, 2010; Kaplan, 2009; Bentler, 2005). Also, by following conventional requirements in RML, one variable (first variable) loading per latent factor was set to a fixed value of 1.0 in order to set the metric scale for that factor (Zhong and Yuan, 2011; Kline, 2010; Bentler, 2005). The other variables in each factor were set as free parameters to be estimated through iterative procedures to minimize certain discrepancy or fit function between the observed covariance matrix (data) and the model implied covariance matrix (model) (Wong, 2011; Henseler, 2010; Kline, 2010; Lei and Wu, 2008).

The full model estimation process used the total 208 number of cases for the analysis of the information flow and information composition models (see Figures 7.2 & 7.3). It is emphasized that, a properly specified and estimated model will always converge (Wong *et al.*, 2010; Henseler, 2010; Lei and Wu, 2008). The models assessing the information flow and information composition converged at the 16th and 22nd iterations respectively suggesting that, the models under study are properly specified.

7.2.8 Model Evaluation

7.2.8.1 Fit Statistics on the Structural Model

A confirmatory factor analysis of the full latent model evaluating the contribution of the unique features of mass housing project to project team communication ineffectiveness in relation to information flow and information composition were conducted. The main hypothesis underlining the full structural model is that *'Multiple Construction Sites Management Style (MCS), Housing Unit Design Contract Packaging (HDP), Multiple Geographical Location for Various Schemes (MGL), Complex Network of Procurement Systems (NPS), Repetitive Tasks Management Delivery Strategy (RDS)'* contribute to mass housing project team communication performance ineffectiveness (PTCE) in relation to information flow and information composition in mass housing project delivery.

The SEM Models are presented in Figures 7.2 and 7.3 (Models 2.0 & 2.1) respectively. The CFA analysis of the full latent model(s) revealed that, the Bentler week's structural representation of the model 2.0 (information flow) had 26 dependent variables, 31 independent variables, 55 free parameters and 32 fixed non-zero parameters. Model 2.1 (information composition) on the other hand, had 27 dependent variables, 32 independent variables, 57 free parameters and 33 non-zero parameters. A well and properly specified structural equation model often has some fixed parameters and free parameters to be estimated from the data (Kline, 2010; Kaplan, 2009; Bentler, 2005). Hence, the two evaluative models (2.0 & 2.1) could be said to be well and adequately specified from the Bentler week's test results.

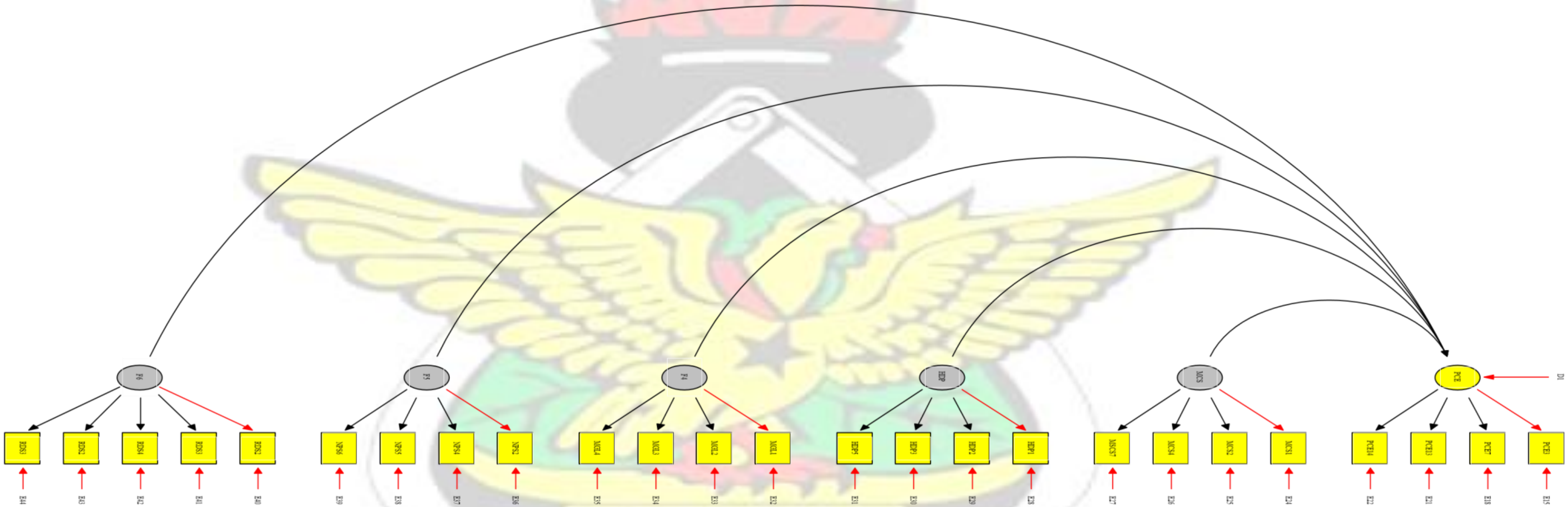


Figure 7.2: Model 2.0 – Contribution of Unique Features to Communication Ineffectiveness (PCE-Information Flow) Model

Parameters (from left to right): Exogenous variables: RDS (5 indicator variables), MGL (4 indicator variables), HDP (4 indicator ariables), MCS (4 indicator variables), Communication Ineffectiveness (information flow) (Endogenous variable) PCE (4 indicator variables).

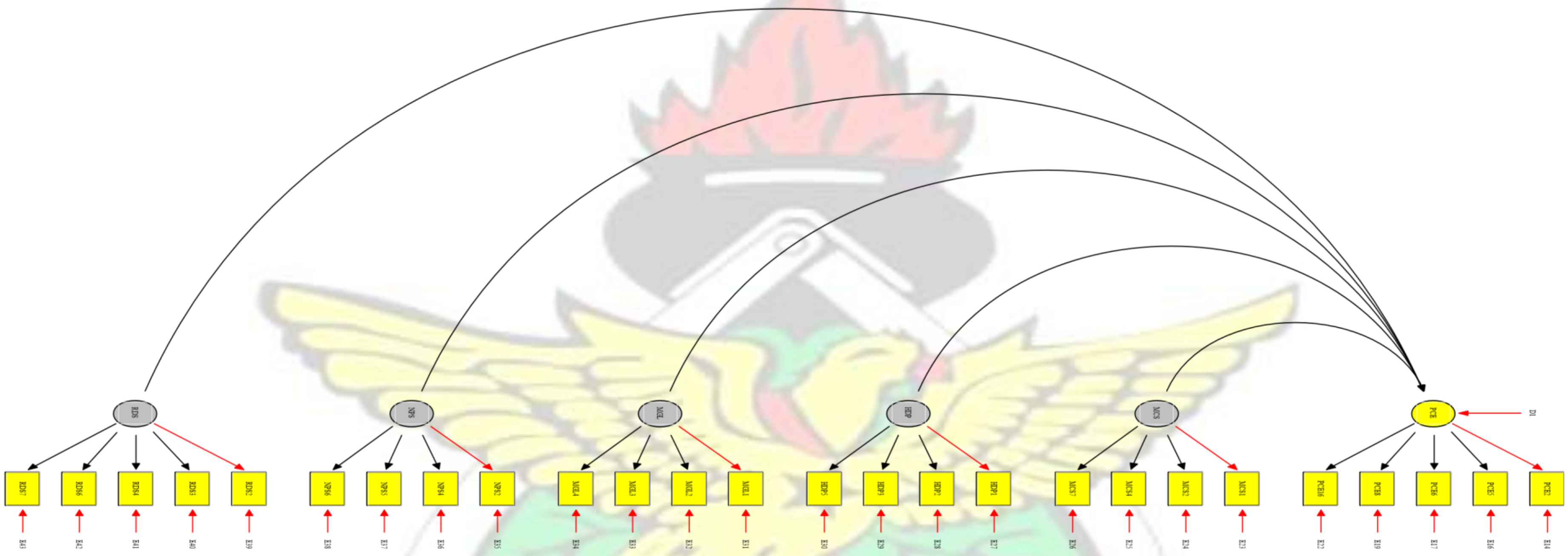


Figure 7.3: Model 2.1 – Contribution of Unique Features to Communication Ineffectiveness (PCE-Information Composition) Model

Parameters (from left to right): Exogenous variables: RDS (5 indicator variables), MGL (4 indicator variables), HDP (4 indicator variables), MCS (4 indicator variables), Communication Ineffectiveness (information composition) (Endogenous variable) PCE (5 indicator variables).

7.2.8.2 Analysis of Residual Covariance Estimate

Bentler (2005), MacCallum *et al.* (2006) and Yuan and Bentler (2001) revealed that, the residual covariance matrix assesses the discrepancies between the matrix to be modeled. This usually refers to the sample covariance matrix and the model (population) covariance matrix (MacCallum *et al.*, 2006; Bentler, 2005; Yuan and Bentler, 2001). Often, for a well acceptable model with no collinearity issues among the variables, average absolute residual values and average off-diagonal residual values for both the unstandardized and standardized matrix should be small (usually centred around 0.00) (Kline, 2010; MacCallum *et al.*, 2006). This shows that, a model is a good representation of the data (Kline, 2010; MacCallum et al., 2006). From the covariance matrix (see Appendix 2), the unstandardized and standardized average off-diagonal residual were 0.0522 and 0.0638 respectively for model 2.0 (information flow). In respect of the covariance matrix for model 2.1 (information composition), the unstandardized and standardized average offdiagonal residual were 0.0535 and 0.0814 respectively.

The significance of this distribution here on the two models is that, these values are indication of structural models that could be described as well-fitting as the distribution of residuals are deemed symmetrical and centered around zero (Byrne, 2006; Yuan and Bentler, 2001). From the above information, the results suggest that, the overall hypothesized structural models evaluating both the information flow and information composition had a good-fit to the sample data and well fitting. Subsequently, further tests were necessary for the acceptance or the rejection of the full models (Kline, 2010; Kaplan, 2009; Byrne, 2006).

7.2.8.3 Structural Model Goodness-of-Fit statistics – Robust Maximum Likelihood

Chi-square statistics are useful in further assessing the fit of the model to the data (Bentler, 2005). When the null hypothesis set for the model is true, the model should fit the data well and the probability should exceed a standard cut off in the χ^2 distribution such as p>0.5 or 0.1 (Wong, 2011; Kline, 2010; Bentler, 2005). The tested hypothesis that, the overall communication ineffectiveness due to the influence of the unique features of MHPs is the measure of the contribution of five factor structure as exogenous variables on one factor project team communication ineffectiveness due to information flow and composition as endogenous variables as depicted in models 2.0 & 2.1. Using the total 208 cases on the models and adopting the RLM, the chi-square test (χ^2) yielded 1180.713 based on 270 degrees of freedom (df) with a probability value of 0.000 for model 2.0 (information flow) and 1200.598 based on 294 degrees of freedom (df) with a probability value of 0.000 for model 2.1 (information composition) at 5% probability level (see Table 7.10).

The chi-square index suggested that the difference between the hypothesized model and the sample data matrix was significant. However, the high sensitivity of the chi-square test to sample size and normality of data makes it an inadequate test statistics and thus not very reliable (Zhong and Yuan, 2011; Kline, 2010 Bentler, 2005). Against this, a normed Chi-square value is usually adopted by most researchers and thus very symbiotic and conventional to the RLM method (Markland, 2007; MacCallum *et al.*, 2006; Byrne, 2006; Bentler, 2005). The normed chi-square is the procedure of dividing the S – Bχ^2 by the degrees of freedom. From Table 7.10, the normed Chi-square value for the two models were

4.370 and 4.421 for models 2.0 and 2.1 respectively (see Table 7.10). From these results, all the normed chi-square values were less than the upper acceptable limit of 5.0.

Table 7.10: Robust Fit Indexes for Structural Model Testing Contribution of Mass Housing Features to Information Composition and Information Flow

Robust Fit Indexes for Project Team Communication Performance Effectiveness (PCE) Outcome Factor (Information Flow)

Fit Index	Cut-off value	Estimate	Remarks
χ^2 $S-B\chi^2$		1180.713 on 270 degrees of freedom 1179.9171 on 270 degrees of freedom	
df	*x>0.00*	270 (Normed= 4.370)	Acceptable fit
CFI	x≥0.90 (acceptable), x≥0.95 (good fit)	0.936	Acceptable fit
GFI	x ≥ 0.90 (acceptable) x≥0.95 (good fit)	0.989	Good fit
SRMR	x≤ 0.08 (acceptable) x≤ 0.05 (good fit)	0.066	Good fit
RMSEA	x≤ 0.08 (acceptable) x≤ 0.05 (good fit)	0.028	Good fit
RMSEA 90% CI		(0.020, .065)	Good fit
p-value	x≥ 0.05	0.000	
$S-B\chi2$		1229.8948 on 294 degrees of freedom	
df	x>0.00	294 (Normed= 4.421)	
CFI	x ≥ 0.90 (acceptable) x≥0.95 (good fit)	0.899≃ 0.900	Acceptable fit
GFI	x ≥ 0.90 (acceptable) x≥0.95 (good fit)	0.902	Acceptable fit

Robust Fit	SRMR	x≤ 0.08 (acceptable) x≤ 0.05 (good fit)	0.042	Good fit
	χ^2		1200.598 on 294 degrees of freedom	

Indexes for Project Team Communication Performance Effectiveness (PCE) Outcome Factor (Information Composition)

	RMSEA	x≥0.95 (good fit)		Good fit
	RMSEA 90% CI	x≥ 0.05	(0.017, .901)	Acceptable fit
	p-value		0.000	
x ≥ 0.90 (acceptable)			0.041	

Table 7.11A: Factor loadings, *Z*-statistics, Variance accounted for & reliability and construct validity of Model Testing (Information Flow)

Indicator Variable	Unstandardized Coefficient (λ)	Standardized Coefficient (λ)	(Z-values)	R Squared (R^2)	Path Coefficient	Cronbach's Alpha	Rho Coefficient	Significant at 5% level?
MCS1	*****	0.651	9.305	0.526				.000
MCS2	0.802	0.845	10.152	0.764				.000
MCS4	0.782	0.691	7.667	0.614				.000
MCS7	0.563	0.532	6.783	0.429	0.552			.001
HDP1	*****	0.801	11.011	0.642				.000
HDP2	0.606	0.608	9.806	0.460	0.156	.733	.821	.000

HDP3	0.563	0.683	12.055	0.594		.000
HDP5	0.921	0.917	14.169	0.841		.000
MGL1	*****	0.478	6.739	0.228		.008
MGL2	0.551	0.724	10.204	0.524		.000
MGL3	0.191	0.230	3.241	0.053		.014
MGL4	0.467	0.663	9.343	0.440	0.586	.000
NPS 2	*****	0.674	14.533	0.646		.000
NPS 4	0.552	0.503	11.501	0.352		.000
NPS 5	0.644	0.642	14.591	0.672		.000
NPS 6	0.632	0.514	12.392	0.504	0.608	.000
RDS2	*****	0.690	14.125	0.524		.000
RDS3	0.753	0.704	14.481	0.546		.000
RDS4	0.562	0.533	9.367	0.301	0.032	.000
RDS6	0.696	0.672	12.655	0.500		.000
RDS7	0.792	0.763	16.496	0.645		.000
PCE3	*****	0.691	11.414	0.478		.000
PCE7	0.873	0.806	20.302	0.650	0.571	.000

PCE13	0.869	0.783	18.489	0.613				.000
PCE14	0.873	0.806	20.302	0.650				.000

********* Parameter estimate fixed as 1.00 required under Robust Maximum Likelihood Test**

Table 7.11B: Factor loadings, *Z*-statistics, Variance accounted for & reliability and construct validity of Model Testing (Information Composition

Indicator Variable	Unstandardized Coefficient (λ)	Standardized Coefficient (λ)	(Z-values)	R Squared (R^2)	Path Coefficient	Cronbach's Alpha	Rho Coefficient	Significant at 5% level?
MCS1	*****	0.651	9.305	0.526				0.000
MCS2	0.802	0.845	10.152	0.764				0.000
MCS4	0.782	0.691	7.667	0.614				0.038
MCS7	0.563	0.532	6.783	0.429	0.532			0.002
HDP1	*****	0.801	11.011	0.642				0.000
HDP2	0.606	0.608	9.806	0.460				0.000
HDP3	0.563	0.683	12.055	0.594				0.000
HDP5	0.921	0.917	14.169	0.841	0.486			0.000
MGL1	*****	0.478	6.739	0.228				0.000
MGL2	0.551	0.724	10.204	0.524				0.025
MGL3	0.191	0.230	3.241	0.053				0.000
MGL4	0.467	0.663	9.343	0.440	0.203	.684	.703	0.000

NPS 2	*****	0.674	14.533	0.646		0.000
NPS 4	0.552	0.503	11.501	0.352		0.000
NPS 5	0.644	0.642	14.591	0.672		0.001
NPS 6	0.632	0.514	12.392	0.504	0.581	0.021
RDS2	*****	0.690	14.125	0.524		0.000
RDS3	0.753	0.704	14.481	0.546		0.020
RDS4	0.562	0.533	9.367	0.301	0.801	0.000
RDS6	0.696	0.672	12.655	0.500		0.000
RDS7	0.792	0.763	16.496	0.645		0.000
PCE2	*****	0.720	9.916	0.561		0.030
PCE5	0.803	0.904	16.390	0.821		0.000
PCE6	0.772	0.871	11.443	0.786	0.704	0.000
PCE8	0.825	0.866	10.301	0.701		0.004
PCE16	0.837	0.945	24.611	0.856		0.010

********* Parameter estimate fixed as 1.00 required under Robust Maximum Likelihood Test**

According to Kline (2010), Iacobucci (2010) and Byrne (2006), a normed chi-square value up to 3.00 are considered a very good fit whereas those up to 5.0 are deemed acceptable fit and are thus recommended. Hence the normed chi-square values fell below the acceptable limit of 5.0 and are thus suggestive of acceptable fit (Kline, 2010; Iacobucci, 2010; Byrne, 2006). Hence it can be inferred that the hypothesized models 2.0 and 2.1 reasonably and adequately fit the sample data.

Additionally, the robust CFI, GFI, SRMR and RMSEA fit index in Table 7.10 indicated acceptable and good fit levels of both models and thus an indication of good conditions for the model acceptance. Likewise, the Rho Coefficient and the Cronbach's Alpha Coefficient examined indicated an acceptable level of internal consistency and reliability in the measures as they all approximately met the 0.7 desired minimum level. Hair *et al.* (20014) and Wong (2011) indicated that, a level greater than 0.5 is considered acceptable. These results indeed offer a testament to the fact that, the responses given are consistent across all indicator variables thus the measure of the contribution of the unique features to mass housing project team communication ineffectiveness are deemed consistent. Subsequently, the test statistics reported in Tables 7.11 (A & B) were all greater than the conventional lower limit of 1.96 based on the probability level of 5%, thus suggestive of significant parameters in the models (Kline, 2010; Iacobucci, 2010; Kaplan, 2009; Byrne, 2006).

7.2.8.4 Results of the Evaluative Structural Model Hypothesis Testing

The prime significance to SEM analysis is how best the model generated is feasible as well as how the obtained solution satisfies the hypothesis being tested (Kline, 2010;

Wong, 2011; Hair *et al.*, 2014). Following the assessment of the goodness-of-fit of the structural models, a further inspection was done on the obtained solution and this involved the inspection of the statistical significance of the parameter estimates and the test statistics to judge the feasibility of the models (Kline, 2010; Kaplan, 2009; Lei and Wu, 2008). The solutions obtained are presented in Tables 7.11 (A & B). The standardized estimates and the test-statistics (Z-test) obtained in the solution revealed that the parameter estimates were reasonable in terms of their magnitude, signs and statistical significance and thus adequately measures more than 25% (above moderate effect on their respective construct). This is because their Z-test statistics were greater than the conventional minimum of 1.96 and their respective factor loadings and predictive determinants (R^2) were significant (Kline, 2010, Byrne, 2006; Bentler, 2005).

Figures 7.4 and 7.5 are graphical representation of the full structural models showing the contribution of the various factors on their respective endogenous factors. From, Figure 7.4 and Table 7.11A, the coefficient of determination (R^2) is 0.572 for the PCE endogenous latent variable for information flow related project communication effectiveness. This means that the five latent variables (factors) (MCS, HDP, MGL, NPS and RDS) contribute to 57.2% of the variance in Mass housing project team ineffectiveness related to information flow. The factor loadings of each of the unique features on the overall project team communication ineffectiveness (endogenous variable) in relation to information flow is contained in Table 7.11 A and Figure 7.4. The path coefficient loadings are the composite effect of the factor (R^2) on the endogenous variable which is interpreted as the model's predictive accuracy and thus represents the exogenous variable's combined effect on the endogenous variable(s) (Hair *et al.*, 2014 & 2013).

EQS 6 titus usefinal200 phd.eds Chi Sq.=1180.70 P=0.00 CFI=0.936 RMSEA=0.028

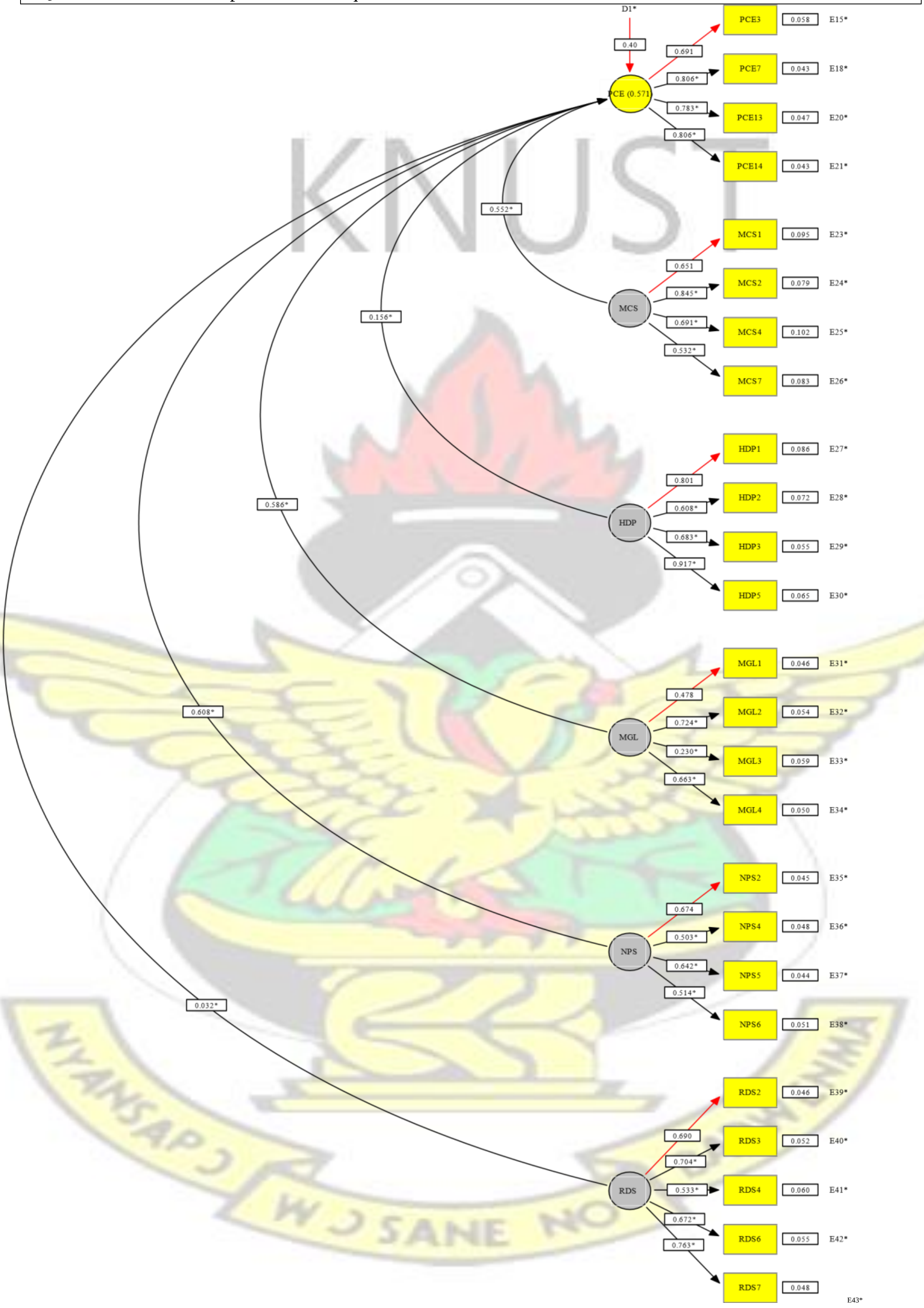


Figure 7.4: Results of the information flow Communication Ineffectiveness model

EQS 6 teefinal200 phd.eds Chi Sq.=1200.60 P=0.00 CFI=0.899 RMSEA=0.041

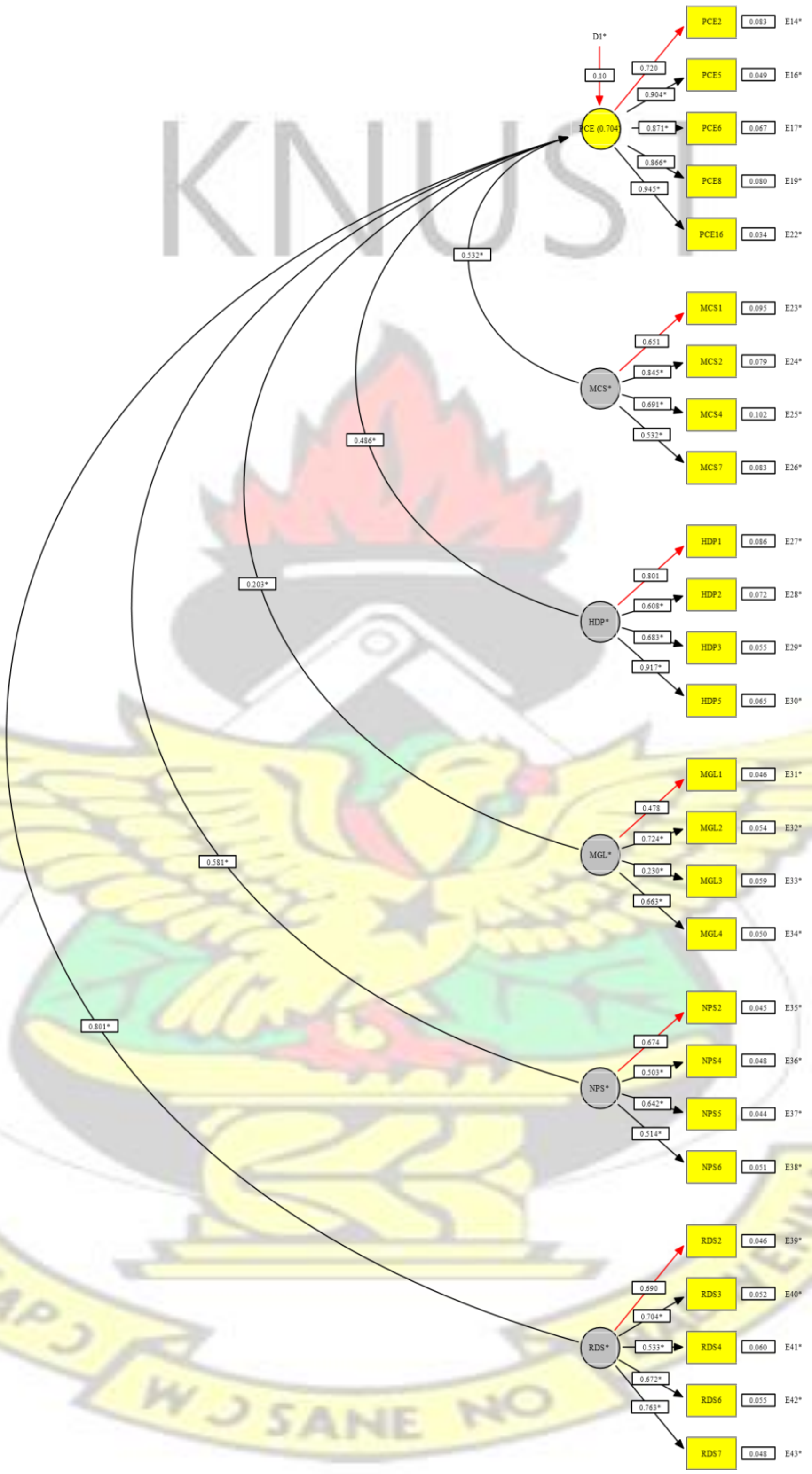


Figure 7.5: Results of the Information Composition Communication Ineffectiveness

model

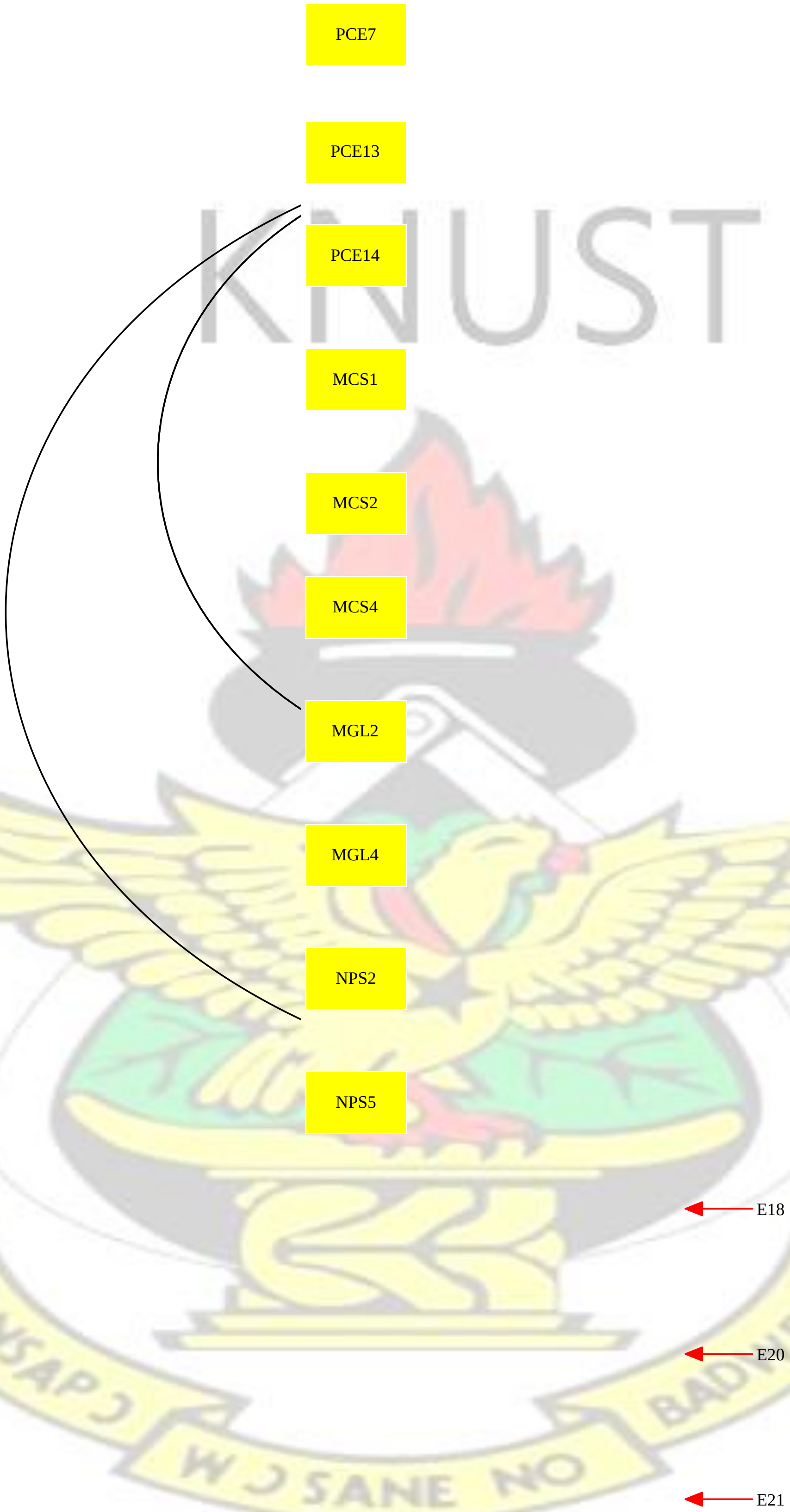
According to Hair *et al.* (2014), this effect range from 0.00 to 1.00 with 1.00 suggesting an absolute predictive accuracy. It is further indicated that R^2 values of 0.75, 0.50, 0.25 describes substantial, moderate, or weak levels of predictive accuracy respectively (Hair *et al.*, 2014; Iacobucci, 2010; Henseler *et al.*, 2009). Iacobucci (2010), Hair *et al.* (2014) and Frank *et al.* (2008) revealed that, an R^2 value less than 0.100 is counted as an insignificant effect on the endogenous variable. This means that, in evaluating the contribution of the unique features of mass housing to project team communication ineffectiveness in relation to information flow, the results in Tables 7.11A and Figure 7.4, the factor loadings and effects indicate that the factors MCS contribute about 55%
(0.552), HDP contribute 15% (0.156), MGL contribute 58% (0.586), NPS contribute 60% (0.608) and RDS contribute 3% (0.032) respectively of the total 57.2% variance in the information flow communication ineffectiveness among the team. Analysis of the inner model suggests that NPS has the strongest effect (contribution) on information flow related communication ineffectiveness among the project team, followed by MGL, MCS and HDP. The contribution by RDS could be seen as the least and considered insignificant. Subsequently, the results of the R^2 in the information flow communication ineffectiveness revealed *PCE7- Late delivery of needed communicated information,*
PCE13- Difficulty in disseminating information among project team and PCE14Difficulty in accessing communicated information from channels emerged as the dominant information flow communication ineffectiveness (R^2>0.5) that occurs among the project team.

The results in Figure 7.5 and Table 7.11B on the other hand revealed the total effect of the features of MHPs on project team communication ineffectiveness in relation to information composition. The overall coefficient of determination (R^2) of information composition related communication ineffectiveness (endogenous latent factor) on mass housing project team communication (PCE) was 0.704. This means that the five (5) latent variables of MCS, HDP, MGL, NPS and RDS contribute to about 70.4%% of the variance in MHPs team ineffectiveness related to information composition.

In evaluating the contribution of the individual factors (features) to project team communication ineffectiveness in relation to information composition, the results of the factor loadings and effects in Tables 7.11B and Figure 7.5 indicate that, the factors MCS contribute about 53% (0.532), HDP contribute 48.6% (0.486), MGL contribute 20% (0.203), NPS contribute 58% (0.581) and RDS contribute 80% (0.801) respectively of the total 70.4% variance in the information composition communication ineffectiveness. Analysis of the model suggests that, RDS has the strongest effect on information composition related communication effectiveness among the project team, followed by NPS, MCS and HDP. The contribution by MGL could be seen as the least. Additionally, it can be suggested from the results that, though information composition ineffectiveness among the project team inherent in the unique features was about 70% and deemed more dominant and substantial over information flow ineffectiveness, it occurrence was seen in all the five variables (PCE2, PCE5, PCE6, PCE8, PCE16). This is an indication that *PCE2-Lack of consistency in communicated information leading to lack of coordination among project team, PCE5- Receiving conflicting information from team participants,* *PCE6- Lack of clarity in communicated information resulting in different interpretations, PCE8-Misunderstanding of communicated information* and *PCE16-Lack of defined roles and responsibilities among members of the team leading to communication failure* were the frequent communication ineffectiveness among the team on mass housing.

The Results from the SEM analysis yielded support for the hypothesis, and further suggested that, the experience of mass housing project team communication ineffectiveness in relation to project related information composition is more intense or greater compared to that of information flow. Conclusively, the overall results therefore suggest that the exogenous variables (unique features of mass housing projects) considerably influence the endogenous variables (project team communication ineffectiveness).

It is important in SEM analysis to clearly understand the significance and the effects (contribution) of the latent variables to the endogenous (dependent) variables (Kline, 2010; Bentler, 2005). Generally, SEM analysis can evaluate either direct effect, indirect effect or total effect (Iacobucci, 2010; Kline, 2010; Byrne, 2006; Bentler, 2005). Here in this study, the objective was to evaluate the direct effect of the latent variables on the communication effectiveness among the MHP teams. The assessment presented offers a empirical account of the extent of direct effect of the various features of MHPs on the information flow and information composition communication ineffectiveness. In several studies in SEM analysis, in assessing direct effect of variables, often a weak contribution of variables may suggest a significant indirect contribution (see Iacobucci, 2010; Kline, 2010; Wong, 2010; Byrne, 2006; Bentler, 2005). However, the assessment of the indirect effect here was beyond the scope of this study. Hence, a decision to retain these variables for reason of indirect effect would be most inappropriate if not based on an empirical assessment (Iacobucci, 2010; Bentler, 2005). Against this, by focusing on the extent of effects of the various varaibles (see Tables 7.11A & B), the decision taken was that, all the variables that were making weak and insignificant contribution were subsequently droped to refine the evaluative models. Hence the refined evaluative models measuring the information flow and information composition communication ineffectiveness among the mass housing project team are presented in Figures 7.6 and 7.7 respectively.


PCE7
PCE13
PCE14
MCS1
MCS2
MCS4
MGL2
MGL4
NPS2
NPS5
E18
E20
E21

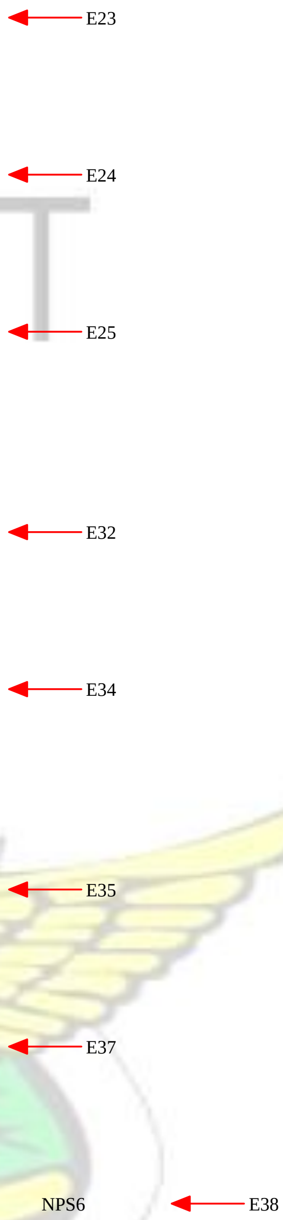
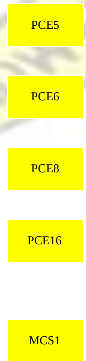


Figure 7.6: Refined Evaluative Information Flow Communication Ineffectiveness model



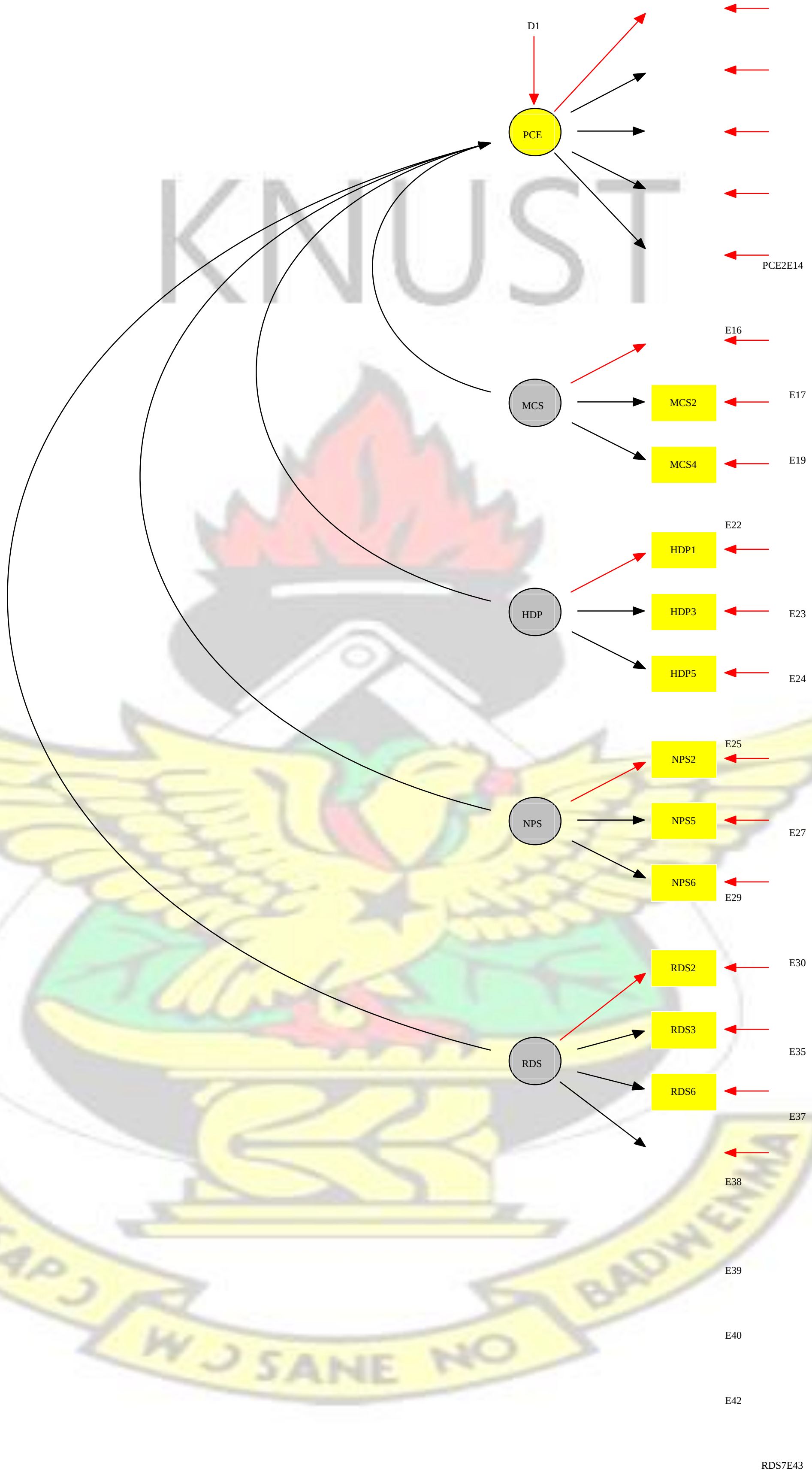

D1
PCE
PCE2E14
E16
MCS
MCS2
E17
MCS4
E19
E22
HDP1
HDP
HDP3
E23
HDP5
E24
E25
NPS2
NPS
NPS5
E27
NPS6
E29
RDS2
E30
RDS3
RDS
E35
RDS6
E37
E38
E39
E40
E42
RDS7E43

Figure 7.7: Refined Evaluative Information Composition Communication Ineffectiveness model

7.2.8.5 Summary on the SEM Models

The results from the SEM output indicated that, the postulated hypothesized model(s), (information flow and information composition project team communication ineffectiveness) fit the sample data adequately. This was due to the fact that the observed discrepancy between the sample covariance matrix and the model (population) covariance matrix were insignificant. Likewise, the robust CFI, GFI, SRMR and RMSEA fit index values met the cut-off index criteria and the parameter estimates were found to be statistically significant and reasonable. The path coefficient (coefficient of determination) and the standardized parameter estimates reveal weak, moderate and substantial effect respectively to the overall communication information flow and composition ineffectiveness. Hence, the results suggest support for the hypothesis that the unique features of mass housing indeed influence communication ineffectiveness among the project team. Based on the extent of direct effects of the variables, the refined models are also presented. The discussions are presented in the next section.

7.3 DISCUSSION OF RESULTS

From Section 7.2.8 of this chapter, a veritable and detailed description of the Structural Equation Model(s) for evaluating the contribution of the unique features of mass housing to project team communication ineffectiveness has been presented. The results confirm the evidence in extant literature that, the uniqueness of mass housing project indeed potentially induce communication ineffectiveness in mass housing delivery among the project team as espoused by Ahadzie *et al.* (2014), Ibem *et al.* (2011) and Enshassi (1997). By drawing on the findings as well as practical and theoretical perspective in the management and communication task performance in the mass housing construction industry, this section presents the discussion and the implication of the findings to stakeholders and management of mass housing in the industry.

7.3.1 Multiple Construction Sites Management Style (MCS) Features

The results from the confirmatory factor analysis presented in Table 7.11 (A & B) reveal that multiple construction site management style factor significantly contribute to the overall mass housing project team communication ineffectiveness with relatively similar effects in regards to information flow and project related information composition. It is further noted that the variables *contractor management style adopted on housing units under scheme*, *site management style adopted on the housing units under scheme* and *change orders (Variation Orders) procedures adopted on repetitive housing units under scheme* were the main substantial contributors to the overall impact of the factor. The variable *Quality Management style and approach adopted on housing units and overall scheme(s)* was perceived to make weak contribution to the level of communication ineffectiveness.

Blismas (2001) revealed that multiple nature of construction sites presents unique challenges to its management, team function, communication and procurement.

Additionally, Enshassi (1997) studying managerial effectiveness and site organization on MHPs in the Gaza strip indicated that, the multiple site nature of mass housing schemes inherently affect the working programme to be adopted by the project team across all the units under packaging. He further elaborated that, this consequently affects the nature of information to be shared on efficient and economical method of carrying out the work, for continuous productive work, for all the operatives employed, to facilitate organization, coordination and control of all tasks and activities across all the units. It is also perceived to affect the accuracy of information shared relating to material delivery on all units being managed by the team on all sites (Enshassi, 1997). Likewise, Oladapo (2002) affirmed that mass housing projects exhibits unique project organizational and management settings that inherently induces communication inefficiencies in the Nigerian industry. The organizational set up often results in communication challenges and information break down (Oladapo, 2002). Ahadzie *et al.* (2014) also hinted that, the multiple site nature of mass housing projects have serious implications for communication among the project team as well as information and documentation management on site and this consequently often results in productive time loss.

Construction projects which share multiple construction sites are characterized by large numbers of similar sub-projects undertaken regionally, nationally or globally as part of a single medium to long-term project and thus presents challenges in respect of site set-up, sharing of project related information and decision making (Zairul and Rahinah, 2011; Blismas, 2001). Regarding nature of management concepts and multiple site of mass housing units being managed, the results indicated that, communication ineffectiveness among the team is substantially affected in both the flow of information and information composition. In this regard, the *site management concept* and c*hange orders (Variation Orders) procedures on repetitive housing units under scheme* adopted in the delivery of the housing units greatly influence the communication outcome. The site management structure on construction projects define the organizational structure that consequently builds up the structure for the project team communication, documentation and informantion management (Liu, 2009). It is suggested that poor site management organizational structure greatly induces communication problems such as information omission, gatekeeping, underload and overload (Khanzadi *et al*., 2008; Xie, 2002).

However, the emergence of this is not surprising. Drawing on the practical and theoretical perspective of site activities and organization of most mass housing project site, there are enough evidence of poor site management, weak organizational set up and undefined roles among the team managing the projects. This development in no doubt, could plausibly account for this results. Practically, it could be indicated that, only few of the registered GREDA members executing mass housing developments have properly defined and well organized site structures that enhances communication and information flow.

Additionally, even though the emergence of these findings is in congruence with other findings on traditional 'one-off' projects, Blismas, (2001) however established that projects with multiple construction sites predominantly experience site and organizational management complexities requiring continual attention compared to traditional building projects. It is said that a complex site and organizational management structure may increase communication barriers in the communication process as well as obstructing information sharing among the project participants (Liu, 2009). Here the findings suggest that, this feature significantly influence information related inaccuracies, distortions, misunderstanding, barriers, procedure and late delivery. Xie *et al.* (2010) established that, information needs of the project team participants are essentially related to management responsibility and thus ambiguity in the defined roles of the team members that are inherent in poor site management structures significantly causes misunderstanding of essential project information as well as dissemination challenges. The emergence of communication ineffectiveness associated with procedure inherent in this factor indeed affirms the uniqueness of mass housing projects environment in MCS features. Studies by Liu (2009) and Xie (2002) suggested that procedural issues that cause communication problems on traditional construction projects were non-existent on construction projects in China and Hong Kong respectively. Hence, the implication of the findings is for project teams on mass housing to adapt bespoke site and management structure that enhance and facilitate sharing of project related information in procedure and protocols among the team as well as documentation and management of information on site.

7.3.2 Housing Unit Design Contract Packaging (HDP) Features

Factors due to project organization such as design characteristics and contract packaging are considered as critical factors that often induce team break down and communication ineffectiveness among project teams leading to project failures (Khanzadi *et al.*, 2008). In repetitive design projects, it is said that good contract packaging is very useful in ensuring good design management and delivery efficiencies (Gray and Hughes, 2001). Here in this study, the 'Composition of housing design in each contract package under housing scheme' and 'Packaging of 'Preliminaries items' adopted under standardized repetitive housing units under scheme' have been revealed to induce both weak and moderate contribution to the communication ineffectiveness. The contributions of these features are significant to the overall contribution of the HDP factor to the information flow and information composition communication ineffectiveness among the project team. Indeed, the results indicate that the overall factor contribute from weak to moderate effect to the information flow and composition ineffectiveness respectively. Even though this contribution can be considered not be substantial, it should not to be taken lightly among stakeholders.

It is well acknowledged that, a well packaged contract on any project type enhances information accuracy, information coordination and mutual understanding of the shared project related information (Liu, 2009; Xie, 2002). The Entrusty Group (2009) and Ong (2007) revealed that, detailed and unambiguous preliminaries organization is critical information that enhances understanding, accuracy and formal obligation of project participants. However, in the practical perspective of mass housing design and contract packaging, various housing units which may be repetitive could be included in one contract packaging. Practically, this often induces challenges in communicating exact scope and content of preliminaries to capture all the various units contained in the package. Chou and Yang (2012) indicated that, contract packaging on construction projects generally influences communication methods, communication requirements and reporting systems among the project participants and thus should be well defined before the start of the project in order to increase mutual understanding of the communication.

The practical antecedent of this finding is that, in developed countries, contracts and packaging are often designed to suit the project environment and associated characteristics (Walker, 2007; Hughes and Murdoch 2001). Additionally, there is frequent review and revision of contracts to suit emerging attributes of projects and project environment (Hughes and Murdoch 2001). These constant and continuous reviews are aimed at ensuring effective project organization, management and coordination towards enhanced results. However, in Ghana and many other developing countries, the situation appears to be different. Here, a standard contractual arrangement and packaging appears to be adopted for all projects without particular practical reference to the needs and challenges on the projects. For example in many developed countries, different contract packaging and arrangements may be adopted on a single project to define the various roles, subcontracting and task activities to enhance management structure, organization and communication. The absence of this practice on mass housing projects coupled with the challenging project environment is likely to account for this related communication ineffectiveness.

Likewise, it is interesting to note that, on mass housing projects, construction and engineering elements adopted are crucial towrads better co-ordination and management of the construction process (Zairul and Rahinah, 20011). However in this study, the feature'Construction elements and components adopted in design units in contract packages under scheme' is perceived not to significantly contribute to communication ineffectiveness. This is contrary to the vast literature reporting of constant communication challenges emanating from concurrent engineering elements and modular systems in construction building project delivery (Anumba *et al.*, 2007; Anumba and Duke, 2007; Anumba and Evbuomwan, 1999). A plausible explanation to this development is that, practically, the approach to housing development especially in Ghana and other developing countries is yet to fully adopt and integrate standardized, modular and concurrent elements into the industry as most mass housing development organization still lean towards the in-situ conventional method.

7.3.3 Multiple Geographical Locations for Various Schemes (MGL) Features Issues of expansive and large geographical extent of projects sites have well been acknowledged to induce immense organizational ineffectiveness and communication challenges on construction projects in general (Liu, 2009, Sandhu *et al.*, 2008; Blismas 2001). Ahadzie *et al.* (2014) revealed that mass housing projects expand and spread across wide geographical areas compared to traditional construction projects and this indeed presents documentation and communication complexities which ultimately affect information flow and site communication. Similarly, Blismas (2001) accounted that, multiple and vast geographical locations of construction projects increases virtuality in project teams which consequently causes communication delays, ineffective communication methods and unsuitable barriers to information. Here in this study, the multiple geographical location of mass housing projects have been identified to significantly contribute to project team communication ineffectiveness that relate to information flow.

However in respect of information composition on mass housing projects, it is perceived to make a sickling contribution. It must be well noted that in the Multiple Geographical Location for Various Schemes (MGL) Factor, the features-*'MGL2- Cultural influence within labour work force due to geographical locations'* and *'MGL4-Geographical constraints and challenges due to location influence on repetitive works in housing delivery'* emerged as the dominant variables to significantly influence the contribution of the factor to the overall information flow communication ineffectiveness among the project team. The emergence of these two variables to dominantly contribute to information flow challenges is not surprising. This is because, practically, most mass housing site in Ghana are not well accessible and serviced, lacking good communication infrastructure, making sharing of information beset with teaming challenges resulting in delay and inaccessible information from medium among others.

Project teams need to share project related information that is critical towards coordination of tasks and activities among teams and task leaders. The interplay of varied cultural influences across these different geographical locations is also more likely to impede information flow and mutual understanding inherent in cultural barriers. From the Ghanaian perspective, practically, most construction and task teams on mass housing are multi-cultural. Against this, it is suggested that, in multi-cultural teams, coordination of activities across subsidiaries such as solving variety of problems and task critically depends on effective communication to harmonize and integrate properly (Ochieng and Price, 2010; Faraj and Sproull, 2000). Ochieng and Price (2009) revealed that cultural variations within multi-cultural project environments affects communication effectiveness among construction project team and as such, cultural collectivism must be pursued to solve this. Hayward (2001) also established that, multiple geographical location adding to project team virtuality consequently results in lost context in their communication and prioritizing communication and as such the most suitable communication method, medium must be adopted.

7.3.4 Complex Network of Procurement Systems (NPS) Features

The measure of the contribution of the Network of procurement system to the overall communication effectiveness was assessed based on the unit effect of the team composition, subcontracting style adopted, control and monitoring strategy and the ‘Prospective Buyers’ involvement in the construction process to project related information flow and information composition. The influences of these features to the overall communication ineffectiveness related to information flow and information composition can be termed as very substantial (Hair *et al.,* 2014).

From these effects to the overall communication ineffectiveness among the project team on mass housing projects, the features- Project team composition adopted on the housing scheme, Control, monitoring and coordination style in subcontracting style adopted and Prospective Buyers' involvement in the construction process of housing units under scheme are said to be making substantial contribution to the impact of the factor to the overall communication ineffectiveness. The impact of subcontracting style adopted across housing units under scheme to the mass housing project team communication ineffectiveness is seen to be moderate. The findings here offer empirical support to suggestions by Oladapo (2002) and Ogunsanmi (2012). Ogunsami (2012) outlined that, most mass housing delivery in Nigeria exhibit unique procurement systems of predominant labour only subcontracting with design and supervision of schemes by hired external consultant outside the developing organization in Nigeria. Oladapo (2002) also established that lack of understanding of the uniqueness of mass housing precipitated the seldom achievement of results in mass housing procurement systems adopted in their delivery. Their perspective provided evidence to communication problems especially in typical labour only and mixed level subcontracting on mass housing delivery in Nigeria (Ogunsami, 2012; Oladapo, 2002).

Likewise, Xie *et al.* (2010) and Liu (2009) revealed that, the procurement system adopted on construction projects significantly influences the contractual and communication relationship complexities among the project participants. Xie *et al.* (2010) also revealed that, traditional construction projects suffer communication problems in inaccuracy and incompleteness as a result of complex procurement team relationships. The study further established that communication issues related to procedure and dissemination protocols were non-existent. Also, Liu (2009) studying construction projects in Hong Kong indicated that, misunderstanding, inaccuracies and information underload was common among the project team especially between the consulting team and the contractor. The study again affirmed that issues related to procedure were not common.

Here in this study, the dominant communication ineffectiveness experienced among the team induced by the procurement system features were late delivery of information, barriers to accessing information and difficulty in disseminating (procedure) information in respect of information flow. In the area of information composition related communication ineffectiveness, the induced problems were inaccuracies, distortions, misunderstanding and procedure. According to Syed (2010) and Ibem *et al.* (2011) housing projects require an effective coordination system to facilitate the strategic planning and delivery by clearly understanding the habits, styles of prospective clients and ability to resolves problems related to the needs. It can thus be stressed that, effective coordination of all project activities are communication dependent. In recent times in the mass housing industry in Ghana, the focus has shifted from speculative production to identifying prospective buyers and building for. This means that, the inputs, needs and the involvement of the buyer is significant from the beginning. Syed *et al.* (2010) studying user participation in housing development in Malaysia revealed that, owner involvement increases delivery acceptance and success but not without problems. The inherent problems experienced were disputes, cost overruns from frequent changes due to lack of understanding and managerial and communication breakdown.

Given that, these clients may not be technically inclined could plausibly induce the misunderstanding problems related to the communication. Additionally, in the Ghanaian context, mass housing development companies and institutions use a blend of project team composition of either all team members from the developing organization or a mix of in-house members and external professionals or entirely external consulting team to oversee the development. These are likely to explain the emergence of communication problems related to procedure, misunderstanding and barrires. This could be attributed to the varying organizational cultural barriers and practices of team participants. Indeed the emergence of procedure as communication problem among the team affirm the uniqueness of mass housing projects compared to the findings on traditional construction projects by Liu (2009) and Xie (2002). Interestingly, the contribution of subcontracting to the communication ineffectiveness was identified to be moderate here. Practically drawing on the theoretical management perspective of housing development in Ghana, it could be suggested that, mass housing adopts complex subcontracting arrangements compared to traditional building construction projects (Ahadzie and Amoa-Mensah, 2010). Brace *et al.* (2009) imposed that, multi-layer subcontracting is generally perceived as having a high potential to influence managerial and communication complexieties as well as health & safety implications compared to single-layer subcontracting hence, the revelation of subcontracting to the communication problems needs further assessment.

Additionally, a plausible explanation to these developments in the context of the situation in Ghana is that, practically significant proportions of the mass housing development organizations in Ghana rely on external project teams for their consulting and managerial functions. In most situations, there exist wide and significant variations in organizational culture, language and practices between the consulting firm and the development organizations. These differences could likely induce these information flow and composition ineffectiveness in the construction process leading to communication breakdown and misunderstanding.

7.3.5 Repetitive Tasks Management Delivery Strategy on Housing Units (RDS) Features

The Repetitive Tasks Management Delivery Strategy on Housing Units (RDS) Features explain the techniques, management and delivery strategies adopted on the repetitive tasks, activities and components of the housing units under the scheme being managed. A study by Ahadzie *et al.* (2014) and Zarul and Rahinah (2011) reveled that, mass housing projects are dominated by repetitive multiple designs in their packaging for delivery. Zarul and Rahinah (2011) further established that, mass housing designs apart from being repetitive also use concurrent engineering elements. Gray and Hughes (2001) and Eriksson and Pesämaa (2007) contended that, contract management and effective communication can be enhanced among project teams through good management and other useful aspects in delivering repetitive works.

The results indicated that, the repetitive nature of mass housing projects and its associated task activities, management and strategies account for substantial contribution to mass housing project team communication ineffectiveness related to project related information composition. It further revealed inaccuracies, distortions, misunderstanding and procedure as the predominant communication ineffectiveness associated with the RDS features. In terms of the information flow related communication ineffectiveness, the repetitive task management delivery strategy makes a weak contribution. It can thus be suggested that on mass housing projects, information composition communication problems inherent in the repetitive nature and delivery strategy are prevalent and significant compared to that of information flow.

Thorough assessment of the contribution of the RDS features revealed that, the Cost saving management techniques adopted for standardized repetitive construction works on housing units under scheme, Project delivery times adopted for various housing units under the scheme, Reporting styles adopted for Project Team (PT) communication and dissemination protocols adopted for Project Team (PT) communication on repetitive tasks on units all accounts for a significant contribution to the overall factor. The contribution of the repetitive Task delivery scheduling concept adopted on various housing units variable on the other hand is seen to be very weak (Hair *et al.*, 2014; Iacobucci, 2010). According to Zarul and Rahinah (2011), mass housing unit design, normally involves sharing of information from the architect to the engineer and to the quantity surveyor and thus the repetitive nature of the housing units coupled with the adoption of concurrent engineering elements (CEE) in the design offers urgent need for systematized management and corrdination which often is dependent on effective communication. Anumba et al. (2007) and Anumba and Duke (2007) implied that, the adoption of repetitive designs and concurrent engineering elements especially in housing projects requires a more robust information exchange among team participants across all the stages of project delivery than in traditional construction projects. It also requires appropriate strategies that ensure that all team members stay focus on their roles, operations and responsibilities towards a better coordination of the construction process (Anumba *et al.*, 2007; Anumba and Duke, 2007).

Additionally, Fan and Tserng (2006), Yi *et al.* (2002) and Mahdi (2004) revealed that, the repetitive nature of mass housing project design units does not make Ghant chart an effective progress monitoring and reporting tools but rather, it is more adapted to the use of line of balance. The studies further explained that, even though repetitive designs and elements especially on mass housing projects can achieve managerial success with efficient planning, combination of management intuition, honed experience and analysis are aided by quantitative techniques (Mahdi, 2004; Yi *et al.,* 2002). Likewise, it is indicated that, the repetitive nature of housing design tasks and packaging consequently contribute significantly to information overload and misunderstanding which ultimately affects delivery (Khanzadi *et al.*, 2008; Mahdi, 2004; Enshassi, 1997).

While the repetitive nature of mass housing may be siginicantly useful in its planning and delivery schedule performance, it induced communication challenges demand the most appropriate and suitable communication methods, strategies, planning, skills and management that can ensure effective communication among mass housing project teams in managing the repetitive tasks, activities and elements.

7.3.6 Significance of the findings towards engendering Mass Housing delivery Project Team Communication Performance

The significance of effective communication to project delivery coupled with the recognition of the positive relationship between communication practices and managerial efficiencies, communication effectiveness always engage stakeholders' in the global construction industry (Ingason and Jonasson, 2009; Marshall-Aoud and Pointing, 2005; Crawford *et al.*, 2005; Xie, 2002). Hence, from the foregoing findings and discussions on the contribution of the unique features of MHPs to project team communication performance, it is extremely important to identify and distinguish between the contribution to information flow and information composition induced ineffectiveness to serve as a micro assessment to better engage stakeholders on the application of the results towards improving team communication performance, adaptable methods and strategies on mass housing projects.

While stressing that, the need for effective communication is critical and complimentary to team building, technical performance, coordinating and organizational functions of project teams and enhanced project outcome, project information flow and information composition remain the critical tenets of communication effectiveness. This ensures stable mutual understanding of project related information to aid job related tasks and activity functions of the team on mass housing projects. Hence the identification of the nature of impact of MHPs features on communication performance remains critical towards initiating appropriate steps and actions to engender improved communication outcome. Unfortunately the significance of this is not well recognized especially among stakeholders and practitioners in the management and development of mass housing projects especially in Ghana and other developing countries in the sub-Saharan African region.

Here in this study, the communication factors were conceived and operationalized as the unique features of mass housing projects that potentially induce communication ineffectiveness among mass housing project teams. Against this, it can thus be suggested that, the determination of the extent and nature of contribution to communication ineffectiveness here should be very significant to project teams, practitioners and stakeholders in mass housing development. They are seemingly expected to identify, adopt, develop and exhibit tailored strategies, methods, skills, management, organisation and documentation concepts associated with the communication threats inherent from these features so identified. This can be judged to bring to mass housing project delivery better and effective communication compared to when these factors are not considered in their communication and management planning.

Also, the centrality of the significance of the findings here is underpinned by the fact that, in main stream project management practice and human resource development in recent times, the focus has shifted from the 'one-fit all' approach to development of concepts, skills, approach and methodology to ones that are defined by project typologies to engender enhanced performance and delivery outcome (Crawford and Cooke-Davies., 2010; Muller and Turner, 2007; Muller and Geraldi, 2007; Crawford *et al.,* 2005). It is expected that if the communication ineffectiveness among the mass housing project team inherent in the unique attributes are practically and theoretically operationalized in the mass housing project environment and the housing industry at large, then, practitioners, team professionals and stakeholders could engender human resource development and training agenda to develop skills and knowledge necessary to effect absolute communication performance on mass housing project delivery.

Additionally, the emergence of features such as *Multiple Geographical Location for Various Schemes (MGL), Complex Network of Procurement Systems (NPS), Multiple Construction Sites Management Style (MCS)* and *Repetitive Tasks Management Delivery Strategy (RDS)* accounting for the dominant and substantial effects (variance) in the overall information flow and information composition related communication ineffectiveness indicates the uniqueness of the MHP environment. The overall assessment carried out accords each unique feature the degree of its potential contribution to the overall communication effectiveness outcome which in effect allows for critical appraisal and implications to the mass housing industry. The contribution of these unique features to the communication outcome deduced from the analyses once again emphasizes the need for stakeholders to re-think the communication technological infrastructure they propose and develop for delivering mass housing projects.

As indicated by the assessment and the general comments, CPFs such as *Site management style adopted*, *Geographical constraints and challenges due to location influence on repetitive works and housing delivery*, *Dissemination protocols adopted for Project Team (PT) communication, Project team composition adopted on the housing scheme under management* and *Project delivery times adopted for various housing units under the scheme* which have high potential to influence communication ineffectiveness among the team indeed affirm the position of the school of thought of the impact of ICT to ameliorate communication challenges on construction projects in general and repetitive projects specifically (Mead, 1999; Marshall-Aoud and Pointing, 2005; Yang *et al.,* 2007). Consequently, it affirm the underdeveloped nature of the construction and housing industry in Ghana to adopt and operationalize basic ICT infrastructure such as groupwares, internet, intranet and outlook to effectively ease the communication problems related to repetitive designs, late delivery, misunderstanding and dissemination due to their potential to standardization of information (Perumal and Abu-Bakar, 2011; Yang *et al.*, 2007). This undoubtedly, when pursued, should help in adapting bespoke communication ICT necessary to ameliorate these communication challenges.

In addition, the high contribution of *Dissemination protocols adopted for Project Team (PT) communication and Project team composition adopted on the housing scheme under management* here suggest that, issues of protocols cannot be discounted among mass housing project teams. Particularly, the antecedent of this findings suggest that, especially in the Ghanaian context, there are likely underlying relationship, cultural challenges, complexities and role ambiguities among mass housing project teams. This indeed offer underlying contractual managerial issues and assertiveness which should engage practitioners attention in improving role definition, and team composition towards enhancing mutual information flow and composition on mass housing schemes.

Undoubtedly, it must well be admitted among practitioners that, attaining effective coordination, managerial efficiencies and communication effectiveness is very difficult and inherently challenging in multiple sites, vast geographical locations of mass housing site, complex contractual relationship and repetitive units (Yi *et al.*, 2002; Blismas, 2001). Hence further critical assessment on these revelations can be a useful approach in revealing the nature of inherent communication ineffectiveness between the various professional participants in the team. This has the high potential to help the various team professionals to offer pin-point and tailored approach and strategies such as medium and tools for enhancing communication performance to aid mutual understanding of project related information. Indeed Ibem *et al.* (2011) studied the critical challenges to mass housing delivery by the public sector and identified communication difficulties and managerial inefficiencies as the fourth most critical challenges in post-independence mass housing delivery in Nigeria. Hence, the findings here, must engage stakeholders to develop and assert sound interventions and strategies towards improving the communication and working environment on mass housing projects.

7.4 SUMMARY

In this chapter, critical and empirical assessment of the degree of contribution of the unique features of mass housing projects to project team communication effectiveness has been assessed. This also included the verification of the related hypothesized relationships between the features and the communication performance indicators in an evaluative model. By drawing on the experience and judgment of mass housing project team leaders from the Ghanaian mass housing industry under the umbrella of GREDA, the empirical findings suggest that, the unique features of MHPs exert various contributions (effects) to information flow and information composition related communication ineffectiveness among the project teams. The results generally indicated that, the *Repetitive Tasks Management Delivery Strategy (RDS), Multiple Construction Sites Management Style (MCS)* and *Complex Network of Procurement Systems (NPS) features* have a high contribution to information composition related communication ineffectiveness among the mass housing project team.

In respect of information flow related communication ineffectiveness among the team, there is a clear revelation that suggest *Multiple Construction Sites Management Style (MCS), Multiple Geographical Location for Various Schemes (MGL)* and *Complex Network of Procurement Systems (NPS) features* exhibiting high contribution to the communication performance experienced by the team. The results indeed revealed some communication ineffectiveness that are unique to mass housing projects as well as those common to both

MHPs and traditional ‘one-off’ building projects. This result indeed affirms the uniqueness of MHPs compared to traditional ‘one-off’ construction building projects.

Consequently, the CFA SEM test and analysis truly confirm the goodness of fit of the evaluative model developed and indicate that the model is statistically robust, valid, reliable and trustworthy. From the findings and the results presented, there is indeed compelling evidence that affirm the unique nature of mass housing projects and thus stakeholders and practitioners must as a matter of urgency consider these features in their communication planning, management and strategies to engender communication effectiveness in mass housing delivery. Similarly, the findings are very significance towards the training needs of practitioners and task performers especially professionals in teams to acquire bespoke communication knowledge and skills that are critical to ameliorate the threats of these features to their communication outcome on MHPs. In the next chapter the validation of the findings in the model is addressed and presented.

CHAPTER EIGHT

CHAPTER EIGHT 8.0 VALIDATION OF THE RESEARCH FINDINGS

8.1 CHAPTER OUTLINE

Validity assessment of any research is deemed to demonstrate the strengths and robustness inherent in the results and the research outcome. Similarly, the extent of the acceptance, trustworthiness and the application of the research findings heavily depend on the process of validation undertaken to confirm or disconfirm the research findings realized. It is suggested that, conducting validation also helps in establishing whether the adopted and developed concepts, constructs and methodologies used are sound and reliable. Hence, here in this chapter, the validation process that was undertaken in respect of this research is presented. The chapter expouses and presents the methodological approach and the results of the validation.

8.2 RESEARCH VALIDATION CONCEPT AND PROCESS

Arguably, in policy development, real life interventions, and reforms, research findings serve as empirical provision that provide the necessary insight and support to the implementation of interventions necessary to stimulate the desired improvement. Hence, the validity of research findings about a phenomenon of interest is therefore considered very crucial due to its ability to make a measure accurately represent the truth as well as representing strength and robustness (Hair *et al.*, 2010). However, the concept of validation is perceived to have varying meanings that define the conceptual, methodological, and empirical domain in the research process by various researchers (Hair *et al.*, 2010; Creswell, 2009; Yin, 2009). Creswell (2009) emphasized that, validity of research findings share varying connotations in qualitative and qualitative research.

Against this, there seems to be somewhat concensus suggesting that, validity is more associated with the inferences, conclusions and generalization that are drawn from the results of empirical research through a well defined process (Hair *et al.*, 2010; Creswell, 2009; Yin, 2009; Brewer, 2000). Shadish et al. (2002) following a model by Cook and Campbell (1979), indicated that a very good and effective validation process must address four critical areas of validity which are:

- meet constructs validity
- assess validity of the statistical conclusions
- demonstrate internal validity of the research and
- demonstrate external validity of the research

Hence, Tuuli (2009) and Ankrah (2007) opined that, researchers must perceive validity as a function of the design and implementation of research and thus researchers must rather focus on addressing all the questions that can be asked about the four areas of validity above on any piece of research. Likewise, by following the traditional three process of validity developed by Brinberg and McGrath, (1985) which have underpinned several studies in the contemporary era (see Tuuli, 2009; Liu, 2009; Ahadzie, 2007), it is emphasized that, research validity must be attained through the three stages of research process of conceptual, methodological, and empirical domain by assessing the: ○ effectiveness, internal consistency, testability and adaptability of the concepts used ○ efficiency, power (rigour), unbiasness, and explicitness of the methods and ○ benefits, potential practical applications and convergence of findings

It is clearly evident from the two main suggested approaches that, they all seek to achieve the same purpose; that is to ensure internal and external validity. Against this, it can be recalled that the crux of this study was to assess the contribution of the unique features of mass housing project to project team communication performance through the development of an evaluative communication performance model. Hence, it is considered very crucial that, the developed evaluative communication performance model and its consequent generalization and transferability are validated. This is to ensure that, the developed model represents the charateristics of the general population and not specific to the sample used in the estimation (Tuuli, 2009; Ankrah, 2007; Shadish *et al.*, 2002).

Interestingly, one other area which is often a contention and lacks consensus in research validation is the issue of the method and approach to be used in the validation process (Tuuli, 2009; Creswell, 2009; Yin, 2009; Shadish *et al.*, 2002). However, most researchers advice that, the approach and methods to be used must entirely not be different from the one used in the original study (Creswell, 2009; Oppeinhem, 2003; Tuuli, 2009). Given the emphasis that, research validation shares different connotation in qualitative and quantitative researches (Creswell, 2009) makes this statement the more important. This study is positioned in the positivist paradigm (see chapter 4) with a quantitative design as the dominant approach. Hence, in ensuring triangulation and theoretical validity, the same approach was adopted for the validation process. Additonally, the validiation process is designed to answer the four main processes following Shadish *et al.* (2002).

By drawing keenly on the account given in the chapters 5, 6 and 7, it can be affirmed that, the first two elements of construct validity and statistical inference validity have been well addressed through the research process in the three chapters through the use of scales adapted from past research, using a pre-testing survey to ascertain the clarity of the constructs and suitability of the scales and using statistical procedures in the SEM analysis (see Chapters 5, 6, & 7). Hence here in this chapter, the report presented focuses on the external and internal validation of the research findings.

8.3 EXTERNAL VALIDATION

According to Shadish *et al.* (2002), external validity of research findings refers to the extent to which findings can accurately be generalized over variations in persons, settings, treatments, and outcomes. However, even though it is generally perceived that, the essence of external validation is more towards gaining trustworthiness, confidence and meaning in the research findings, it is the process and method of validation that transform research findings into knowledge and theory (Yin, 2009; Creswell, 2009). By critical appraisal of similar studies which were notably PhD studies on model development and evaluation in the construction industry in general, three main aspects of external validation were noted. These were replication, convergence analysis and boundary search towards ensuring the robustness of the findings (Liu, 2009; Tuuli, 2009; Ahadzie, 2007; Ankrah, 2007). Hence, here in this study similar approach was adopted.

8.3.1 Replication and Boundary Search

In replication, repeated studies are conducted with the same set of instruments, research strategy, experimental and theoretical or empirical pathways to determine whether the findings inherent in a given study can yield the same original results (Denzin, 2009; Shadish *et al.*, 2002). However, a valid argument against this approach is that in reality, an exact replication of any research is often considered impracticable because two occasions are not exactly the same (Denzin, 2009; Shadish *et al.*, 2002). Hence the replication approach is rarely used as it is additionally constrained by resource logistics, time and energy consuming (Ankrah, 2007; Tuuli, 2009). Against this background as well as inference from similar studies, the replication approach was not used here (see Ankrah, 2007; Ahadzie, 2007; Tuuli, 2009). However, it is significant to note that, the pre-testing of the instrument preceeding the main survey was indeed relevant in ensuring reliability in the the data to be collected in the main survey (Cresswell, 2009) hence extending validity for the credibility and acceptance of the results.

According to Shadish *et al.* (2002), boundary search of any research study relates to the issue of the conditions under which the research findings from a given study will not hold or be supported. Typically, researchers often rely on replications and convergence analysis over time to outline the scope and boundaries of the findings of any given study. Hence, Denzin (2009) and Bryman (2001) noted that adopting any approach apart from replication and convergence analysis to determine research boundary in related studies is a common rarity. However, due to issues related to time and financial constraints, several similar studies have revealed rigorous convergence analysis as adequate assessment of external validity (see Tuuli, 2009; Liu, 2009; Ankrah, 2007; Ahadzie, 2007).

In this study, due to the time and financial constraints associated with completing a PhD, it was not possible for the external validation to include boundary search. It is however acknowledged that there are some potential boundaries to the findings reported in this research, an example of which could be the country of study (i.e. the research context).

Hence, here in this study, convergence analysis was adopted as the main approach in establishing external validity as this enhances triangulation and theoretical validity with similar studies. Additionally, convergence analysis potentially contributes to search for the boundaries of research findings hence supporting it choice (Shadish *et al*., 2002).

8.3.2 Convergence Analysis

From the perspective of Denzin (2009), convergence analysis of research findings is achieved by using different and independent models, methods, and/or occasions to determine the agreement of substantive research outcomes. From the perspective of Creswell (2009), convergence analysis can be attained by verification of tentative findings from a research study through the use of respondent participation. This approach is underpinned by the argument that, participants' verification of the substantive results of the research generates confidence and trustworthiness in the validity of the findings (Creswell, 2009; Tuuli, 2009).

Additionally, the strength and credence of this approach is its wide adoption in similar PhD studies in the construction industry (Liu, 2009; Tuuli, 2009; Ahadzie, 2007; Ankrah, 2007). Likewise, it must be noted that, the approach and strategy of participants (respondents) verification is in congruence with that, used in the original data collection. Notably, follow up interviews with selected respondents, focus groups and follow-up questionnaire to respondents have been the dorminant strategies widely used (Liu, 2009; Tuuli, 2009; Ahadzie, 2007). Where the follow-up questionnaire to respondents have been used, the format has mainly included verification of the research findings as well as the verification of the relevance of the findings to industry, stakeholders and practitioners, academia etc (see Tuuli, 2009; Liu, 2009; Ahdazie, 2007; Ankrah, 2007). Against this, here in this study, follow-up questionnaire to respondents was adopted. This choice is also supported by the fact that this strategy is in agreement with the initial approach to the main data collection as recommended in literature (Creswell, 2009; Yin, 2009). Hence in conducting the convergence analysis, a three page questionnaire on the tentative findings of the study with a cover letter giving clear instructions on the validation was developed and sent to respondents. The questionnaire was divided into two main sections (section A and B). The section A focused on the verification of the tentative findings from the study whereas section B verifies the potential relevance of the findings to the mass housing industry (see Appendix 2).

8.3.2.1 Respondents of the Validation Survey for the Convergence Analysis

The validation survey was carried out using 10 experts and experienced professionals in the general and housing construction industry with their profile and particulars detailed in Table 8.1.

Table 8.1: Profile of Validation Respondents

No.	Position/Role	Type of Organisation	Area of Practice
1	Project Manager	Vanguard Properties	Housing Develeopment
2	Project Leader	BEIGE Properties & Estates	Housing Development
3	Professional Consultant	Academia	Researcher/Project Management
4	Human Resource	Academia	Researcher/Project Management
5	Project leader	Devtraco	Housing Development
6	Managing Director/Consultant	CIEGH	Mass Housing and Industry Reforms
7	Project Manager	Regimanuel-Gray Ltd	Housing Development
8	Managing Director	BEIGE Properties & Estates	Housing Development
9	Cosntruction Manager	Vanguard Properties	Housing Development

10	Managing Director	Trasacco Estates Dev't Co. Ltd	Housing Development

The respondents were chosen by convenience sampling noting their experience, role and contribution to general construction and mass housing development industry. The validation questionnaires were delivered both personally and through their e-mails after telephone calls have been made explaining the exercise and their acceptance to participate. The summary of profile of the experts used in the validation shows that the respondents occupy recognised positions, have adequate experience and exposure in the general and housing construction issues in the sector. The questionnaire was designed to first highlight the variables identified in the evaluative model that significantly influence communication outcome. It also sought to consequently ask the respondents to draw on their experience and practical experience in the industry and mass housing development to assess on a five point likert scale of 1-5, the extent of agreement to the variables identified in the research. Additionally, respondents were also to indicate the potential importance and the application of the findings to the industry, mass housing communication technology development, training and development and improving mass housing contract design. The results and the feedback received in the validation are presented in Tables 8.2 & 8.3. The responses on the various part of the validation questionnaire (main findings and importance of the findings) are reported in statistical frequencies and mean scores.

8.3.2.2 Results of the Respondent Validation Survey

The results in Table 8.2 represent the responses on the validity of the main research findings whereas Table 8.3 presents the responses on the potential importance of the findings.

Table 8.2: Feedback on Validity of Research Findings

Item (Variables)	Response: Strongly Disagree (1)	Disagree (2) (3)	Neutral (4)	Agree	Strongly Agree (5)	Mean
INFORMATION FLOW COMMUNICATION INEFFECTIVENESS						
Multiple Construction Sites Management Style Features (MCS)	0(0%)	0(0%)	1 (10%)	8 (80%)	1 (10%)	4
Multiple Geographical Location for Various Schemes Features (MGL)	0(0%)	0(0%)	4 (40%)	6 (60%)	0(0%)	3.6
Network of Procurement Systems Features (NPS)	0(0%)	0(0%)	2 (20%)	3 (30%)	5 (50%)	4.3
INFORMATION COMPOSITION COMMUNICATION INEFFECTIVENESS						
Multiple Construction Sites Management Style Features (MSC)	0(0%)	1(10%)	1(10%)	5 (50%)	3 (30%)	4
Housing Unit Design Contract Packaging Features (HDP)	0(0%)	0(0%)	3 (30%)	6 (60%)	1 (10%)	3.8
Network of Procurement Systems Features (NPS)	0(0%)	0(0%)	2 (20%)	3 (30%)	5 (50%)	4.3
Repetitive Tasks Management Delivery Strategy Features (RDS)	0(0%)	0(0%)	0(0%)	6 (60%)	4 (40%)	4.4
				Overall Mean:	**4.2**	

From the summary of responses on the extent of agreement to the findings, the overall mean registered indicated that, almost all the respondents (i.e. 4.2 overall mean) are in agreement to the findings. This suggests that, practically, there is concensus among practitioners that, these features (variables) of MHPs herein identified indeed significantly induce communication ineffectiveness among the project team in mass housing delivery.

Regarding the assessment of the potential importance of the findings, there is strong evidence suggesting that, the findings are indeed very relevant and has a high potential application in the mass housing industry. Generally, there is high concensus among practitioners suggesting that the findings are very important to mass housing communication planning and management, training of mass housing professionals, development of communication course curriculum for the industry professionals and improving contract design packaging on MHPs.

Table 8.3: Feedback on the Potential Relevance and Application of the Findings

Item Feedbacks (importance)	Response					
	Not Very Important (1)	Not Important (2)	Neutral (3)	Important (4)	Very Important (5)	Mean
Mass housing communication planning and management	0(0%)	0(0%)	1 (10%)	4 (40%)	5 (50%)	4.4
Training of Mass Housing professionals	0(0%)	0(0%)	1 (10%)	8 (80%)	1 (10%)	4
Communication technology infrastructure on Mass housing projects	0(0%)	0(0%)	0(0%)	6 (60%)	4 (40%)	4.4
Improving Contract designs and packaging on MHPs	0(0%)	0(0%)	0(0%)	7 (70%)	3 (30%)	4.3
Developing Communication Course curriculum for Construction professionals	0(0%)	0(0%)	2 (20%)	4 (40%)	4 (40%)	4.2
Mass Housing Team selection and composition	0(0%)	0(0%)	1 (10%)	2 (20%)	7 (70%)	4.6

From the consensus reached by the respondents who are perceived to have extensive practical and academic experience and knowledge in MHPs delivery, it suggests a clear indication that the potential application of the findings (model) affirms the reality in the industry. Hence, the findings have a high potential of serving a useful purpose towards improving MHPs delivery if it is practicalized in practice.

8.4 INTERNAL VALIDATION

Internal validity is well recognized as very important among many researchers but unfortunately, there seems to be lack of consensus on the most appropriate procedures for checking internal validity (Fellows and Liu, 2008; Garson, 2011). Intriguinly, in seeking to achieve internal validity on research findings, the predominant strategy has involved attaining convergence boardering on three aspects of Research findings, Published research and Academic validation (Garson, 2011; Fellows and Liu, 2008; Shadish *et al.*, 2002). Drawing on this, most internal validation on research findings typifying these strategies usually seeks to address convergence through key aspects namely literature, questionnaire development, analysis of questionnaire and academic validity (see Tuuli, 2009; Fellows and Liu, 2008; Ankrah, 2007; Ahadzie, 2007). Same approach was adopted here in this study. The following sections are structured to present the commentary on these aspects of the internal validity on this study.

8.4.1 Convergence of Research Design & Findings with Literature

This type of convergence also refered to as theoretical validity indicates the extent of the presence or absence of agreement within the body of knowledge (Denzin, 2009; Tuuli, 2009). It is asserted that, the research findings of any single study by itself contributes little to the body of knowledge unless when the results have rigorously been compared with other studies where the same focal problem is examined that the knowledge about the problem is increased (Shadish *et al.*, 2002; Denzin, (2009). Hence from the preceding chapters, it has been shown that, the research design and findings here given are well supported by extant lieterature. However, for purposes of clarity, these have been briefly elucidated as a summary to typify the convergence between the research design, findings and the research literature.

The attribution theory of communication performance which indicated the external and internal factors as the main contextual 'causal locus' of communication performance outcome is well supported by independent research in extant literature across several domain disciplines such as mass communication, psychology and education (see chapter 4). Studies by Rasekh *et al.* (2012), Salleh (2008) and Weiner (2006) have indeed affirmed the external factors as the dominant contributor to communication performance outcome and thus influencing the focus on the unique characteristics of mass housing projects over the internal factors. Additionally, studies such as Ahadzie *et al.* (2014 & 2007), Ibem *et al.* (2011), Zairuland Rahinah (2011) and Enshassi (1997) emphasized the contribution of the unique attributes of mass housing projects to communication ineffectievess. Hence, these studies corroborate the focus on the external factors and thus lent support to the findings of this research.

Likewise, the CII (1997) communication performance indicator model reflects a comprehensive assessment of communication performance that relates to the degree of accuracy, completeness, understanding, gate keeping, timeliness, barriers and procedures of the communication on the construction project. Hence, the adoption of this is in convergence with several similar studies in extant literature and thus establishes the validity of the study approach, instrument development and the theoretical framework adopted (see chapter 3 and 5).

8.4.2 Convergence of research findings and academic validity

Dissemination of research findings to a wider community through publication of research articles in reputable international journals, peer reviewed conference proceedings, seminars, and workshops are considered ideal academic validation for any research findings (Xiao, 2002; Ankrah, 2007; Ahadzie, 2007). This is due to the fact that, these fora highlighted above allow for peer review process which provides opportunity for the methodologies, meanings and interpretation of research to be rigorously evaluated, critiqued and questioned by independent jurors who are not directly involved in the research (Xiao, 2002). Similarly, the process is also deemed as a critical inquiry which reveals informed comments that indicates the merits of the study as well as offering crucial feedbacks that can potentially enrich and improve the study (Runeson and Loosemore, 1999).

From this study, several doctoral research seminars have been attended; five international conference papers have been presented and published as well as five published journal articles in reputable high impact factor journals. In all these cases, the peer reviewed process allowed referees to outline the basis of their decision giving comprehensive and necessary feedbacks for the work which potentially improved the validity of the study. From these conference and journal publications, rigorous peer review feedbacks received prior to the acceptance of the articles were incorporated in the research and this thesis, thereby improving the study significantly (Xiao, 2002). It additionally, helped in enhancing the robustness and reliability of the findings (Xiao, 2002). The acceptance of the articles also following the peer review process is an indication that, the study has met the acceptable scholarly and academic standards typified by these fora and thus makes the study and findings academically valid.

8.4.3 Convergence of Published Research with Academic Validation

Convergence of Published Research with Academic Validation in any given study is demonstrated through considering the papers and articles cited in the conferences and journals papers emanating from the study. This approach is underpinned by the fact that, by so doing, most of the key arguments, theoretical concepts and findings inherent from the research that is being reported through the publications are well supported by comprehensive literature (Fellows and Liu, 2008; Ankrah, 2007). This is because, it is perceived that inherent publications make sound arguments, interpretatons and evaluation of the key findings against already existing literature and thus the acceptance of these papers for publication support the convergence and academic validation of the content and cited literature (Fellows and Liu, 2008)

This approach has been deemed successfully applied by several researchers such as Ankrah (2007), Ahadzie (2007) and Xiao (2002). The summary of the number of citations in published papers out of the study is presented in Table 8.4.

Table 8.4: No. of Citations in Published Journal and Conference articles/papers

No	Authorship	Year	No. of references cited	Remarks
1	Adinyira et al.	2013	24	Published
2	Kwofie et al.	2013	15	“
3	Kwofie et al.	2014a	62	“

4	Kwofie et al.	2014b	39	“
5	Kwofie et al.	2015a	54	“
6	Kwofie et al.	2015b	34	“
7	Kwofie et al.	2015c	46	Accepted
8	Kwofie et al.	2015d	33	Accepted
9	Kwofie et al.		38	Under review
10	Kwofie et al.		35	Under review
		Total Average	380 38.0	

From Table 8.4 above, a total of 380 published works were cited in the 10 published papers in reputable journals and peer reviewed international conferences. Noting that conspicuously, there were duplication of some citations in some of the papers due to their focus, attribute of addressing similar subject and analytical approach, there were indeed many distinct citations supporting the various findings. The overall significance of these papers cited lies in their use in giving credence and support for the main findings emanating from the study. This is a testament to the fact that, all the main findings of the study are well supported comprehensively by literature. From the established mean citation of 38 per paper as well as the acceptance of the inherent papers from the study, it can be said that, the gross number of citations typify that, there is convergence between published research and academic validation.

8.5 SUMMARY

Here in this chapter, a clear rational approach and design towards the validation of the findings of the study within the key facets of external and internal validation has been presented. The results indicated a general agreement with the findings, thus enhance generalization of the findings. This suggests that, the results of the study are valid and accurately represent the contribution of the unique features of mass housing to communication performance on mass housing projects. Additionally, the results and potential application of the fingings by the respondents revealed general congruence with the practical and theoretical perspective of the mass housing environment and thus deemed very useful towards stimulating enhanced communication effectiveness in MHP delivery.

CHAPTER NINE

CHAPTER NINE

9.0 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

9.1 CHAPTER OUTLINE

The study has explored the contribution of the unique features of mass housing projects to project team communication ineffectiveness through an empirical evaluative model. This subsequently led to the identification of the significant contributing features as well as the inherent dominant communication ineffectiveness caused by these features. In this last chapter, the study is brought to a close by presenting the summary of the entire research, the main conclusions, contribution to knowledge, the limitations of the research and the consideration of the potential implications of the empirical findings to stakeholders and practitioners in the industry.

9.2 REVIEW OF THE STUDY OBJECTIVES

The account of communication ineffectiveness on mass housing projects inherent in its unique attributes compared to traditional construction projects is well acknowledged in numerous studies (Ahadzie *et al.*, 2014; Zairul and Rahinah, 2011; Ibem *et al.*, 2011; Enshassi, 1997). The main aim of this study was to present an empirical evidence to this assertion by investigating the contribution of the unique features of mass housing projects to project team communication performance in its delivery. This led to the formulation of four (4) key objectives necessary to meet the overall aim of the research. In this section, an account is given on how the objectives set for the study were delivered.

9.2.1 Objective One: Establish the Unique Features of Mass Housing Projects Even though there is general acknowledgement of the fact that, mass housing projects have unique characteristics, what constitutes this uniqueness was not well established and researched. Hence the first objective of the study was set up to establish the unique features of mass housing projects. Hence by adopting a comprehensive review of literature on project characteristics and theories of project typologies and categorization, a comparative study was conducted from a managerial perspective to identify the features that distinguish MHPs from traditional 'one-off' construction building projects. The preliminary survey conducted on the identified features to test their acceptance among MHP practitioners and stakeholders indeed affirmed that, MHPs exhibit unique physical, organizational and managerial features (see Adinyira *et al.,* 2013; Kwofie et al., 2013; Kwofie et al., 2014).

The review as well as the preliminary survey establishing the unique features of mass housing project was indeed very relevant and significant in empirically underpinning the view that truly MHPs are unique compared to traditional projects. The detailed account on this objective was presented in Chapter 2.

9.2.2 Objective Two: Identify the communication ineffectiveness (problems) among mass housing project team inherent in the unique features

The second objective of the research was to identify the communication ineffectiveness experienced among project teams perceived to be induced by the unique nature of MHPs. This objective was addressed by undertaking a critical and extensive review of relevant literature on communication problems experienced on construction projects. By adopting

the most comprehensive communication performance measure indicators developed by the CII (1997), sixteen communication problems were adopted and operationalized to reflect the mass housing project environment particularly in Ghana (see Chapters 3 & 5).
The literature review affirmed the lack of studies assessing communication problems of MHPs towards engendering the needed communication effectiveness being craved for on MHPs as opposed to the numerous studies undertaken on traditional projects.

These sixteen communication performance indicators were developed into a questionnaire for project team leaders on various on-going MHPs to draw on their experience and identify the communication problems they experience on their projects. This was done to identify the main communication problems experienced on mass housing projects among the project team with particular reference to the contribution of the unique features of MHPs. This account was presented in Chapters 3 and 6.

9.2.3 Objective Three: Develop a model for evaluating the contribution of unique features of mass housing to project team communication effectiveness

This research objective led to the review of relevant literature, theories and models on communication performance for establishing the necessary constructs, theoretical framework and conceptual model in evaluating the communication effectiveness on MHPs. Though the most established studies on the subject area lack the needed theoretical backing and underpinning, the review relied on relevant literature on mainstream communication, management, psychology and linguistics in order to adopt relevant theories for the study. This led to the identification and subsequent adoption of the 'attribution theory' of communication performance as appropriate for addressing the research aim. The identified gaps from the extensive literature review formed the basis of the main concepts and constructs that underpinned the conceptual model developed for the study (see Weiner, 2006; Rasekh *et al.*, 2012; Kwofie *et al.*, 2014).

The main constructs identified were the communication factors consisting of the unique features of mass housing (external factors), the behavioural communication competencies (internal factors) and the communication performance indicators. In the context of this study and by focusing on the factor indicator approach in assessing and evaluating communication performance effectiveness as well as the main concepts identified, an evaluative measurement model (framework) was established (see chapter 6). This aided an overall coherent approach for the systematic assessment of the contribution of the unique features of mass housing to project team communication effectiveness. Two hypotheses relating to information flow and information composition ineffectiveness were thus postulated priori to verify the influence of the unique features on the communication outcome (see Chapter 7).

9.2.4 Objective Four: Determine the contribution of the unique features to the overall communication effectiveness among the project team

Following the development of the conceptual and postulated priori model, the need to empirically verify and test and identify the unique features that contribute to the communication ineffectiveness among the project team became very evident and necessary. Hence by adopting a positivist paradigm and development of a quantitative inquiry (questionnaire survey), the experience of project team leaders on MHPs by sampled GREDA organisations in Ghana helped to empirically meet this objective.

Through the quantitative inquiry and the subsequent use of the Structural Equation Model (SEM) aided by the EQS 6.2 software, an empirical evidence was given by revealing the extent of contribution of the unique features to communication ineffectiveness on MHPs. The questionnaire design allowed the project team leaders to access the extent of the contribution of the features as well as the nature of contribution of the features to the communication ineffectiveness experienced on the mass housing project. The results of the quantitative inquiry addressing this research objective were presented in Chapter 7.

9.4 MAJOR FINDINGS (CONCLUSIONS)

Against the background of limited studies on the assessment of the communication ineffectiveness inherent in unique characteristics of MHPs among mass housing projects teams, this study has been undertaken in an effort to close the gap in knowledge. By adopting a quantitative approach, this study has provided an empirical assessment of the communication ineffectiveness among mass housing project teams inherent in the unique attributes of MHPs. The evaluation undertaken in this study indicates that, mass housing project teams experience communication problems unique to mass housing projects compared to traditional ‘one-off’ construction building projects.

By drawing on the relationship among the variables, the factor analysis extracted three main components ‘Component 1: Access to Information challenges, Component 2: Challenges in flow of information’ and Component 3: ‘Import of information challenges’

as the main communication problems among the project team on MHPs (see chapter 6 section 6.3). Additionally, from the results of the postulated model and its associated hypotheses testing through the SEM analysis, the study has also given empirical evidence that the communication ineffectiveness experienced among mass housing project team is significantly influenced by Multiple Site Management Concept (MCS), Multiple Geographical Locations (MGS), Complex Network of Procurement System (NPS) and Repetitive Tasks Management Delivery Strategy (RDS). Even though it is well acknowledged in literature on the communication challenges on mass housing inherent in the multiple geographical location natures of MHPs, here the evidence shows that, it is significant in inducing information flow communication ineffectiveness and insignificant in information composition ineffectiveness.

It is clearly evident that, the unique features of MHPs cannot be overlooked, underestimated or ignored in communication planning and management if communication effectiveness is to be ensured on mass housing projects. Hence, these findings have implications for communication management, methods, strategies and media, planning in terms of making decisions which are consequential to mitigating the influence of these unique features in the communication process. The findings thus reinforce the well acknowledged communication challenges and antecedent loss of productive hours due to communication breakdouwn on MHPs. However, considering the significance of effective communication in project delivery and project success, the empirical insight provided by this study, will offer a springboard for mass housing practitioners, stakeholders and the industry at large to adapt their communication planninning and strategies to ensure success. This knowledge will afford them the opportunity to positively adopt mechanisms to influence communication effectiveness on mass housing delivery as well as influencing and managing the contribution of the unique features in the communication process.

Lastly, by drawing on the findings reported in validation (see chapter 8), the responses from the practitioners generally concur with the research results affirming that, the findings, from the practical and theoretical perspective of the mass housing project environment and the industry, are valid and accurately represent the MHP communication ineffectiveness among the team. Also, the potential relevance and application given in the validation exercise suggest that, the study problem and the findings revealed are empirically in congruence with the reality of the communication challenges on mass housing projects and the urgent need for improvement in practice.

9.5 SIGNIFICANCE AND CONTRIBUTION OF THE RESEARCH

It is well acknowledged that, making an original contribution to knowledge is often a contentious issue among scholars especially in doctoral studies due to the arbitrary nature of the concept of originality (Sutrisna, 2004). However, there is no doubt that, this study has provided an insight and significant contribution to knowledge in respect of the uniqueness of MHPs and its inherent communication ineffectiveness. In regards to the uniqueness of mass housing projects, this study has shown through empirical assessment and approach from managerial perspective that, MHPs indeed possess unique physical, organizational and operational features compared to traditional 'one-off' construction building projects. These empirical revelations have indeed affirmed the assertion by Ahadzie *et al.* (2007 & 2014), Mahdi (2004) and Enhassi (1997) and also expoused new areas that needs further research.

In present circumstances in project management practice, effective communication is considered very crucial and hence identifying the communication problems as well as the factors that induce this communication ineffectiveness is considered a vital tool that aids planning and communication infrastructural development towards improvement. Moreover, expanding communication performance measures that fit project typologies and projects of unique charateristics such as mass housing is well acknowledged but has remained an assertion. In this research, an empirical disposition has been proven to identify and outline the communication problems that are inherent in the uniqueness of MHPs. Likewise, it has revealed the various unique features that contribute to the communication ineffectiveness and the nature of influence on the overall communication ineffectiveness. Hence, as a contribution to previous studies on the general body of communication performance in the construction industry, this study has thus put the spotlight on mass housing projects, their unique attributes and inherent communication problems among the project team.

According to Denzin (2009) and Walker (1997), a research could make a significant and original contribution to the body of knowledge through the development of new methodologies, tools and/or techniques. Drawing on this background, another area of contribution to knowledge of this research is its methodological analytical techniques.
Most studies assessing causal relationship between communication performance factors (indicators) and communication factors have predominantly used univariate statistical methods such as ANOVA, MANOVA or Multiple Regression Modeling to develop models of assessment. However, the apparent gap in such models is that, they fail to express the relationships between the individual performance indicators (dependent variables) and individual communication factors (independent variables). This is because such analytical methodologies condense and express several communication performance factors as single dependent variable. In the current study, SEM was used which offers a more robust and

superior approach in assessing causality of factors in a model and their direction of influence as hinted by Byrne (2006) and Bentler (2005). Hence, it can be said that, this is a pioneer study in the use of the SEM approach in assessing communication ineffectiveness hypothesis testing and model development on construction projects. Thus, this offers an empirical and valid approach to specific causal assessment among several independent and dependent variables as opposed to the more general assessment of numerous constructs by the use of ANOVA, MANOVA, Correlation and Multiple Regressions analytical methods.

9.6 LIMITATIONS OF THE FINDINGS

Identifying the limitations of any research helps improve its acceptance and the general applications of the findings. There are some potential limitations that should be borne in mind in the interpretation and generalization of the findings of this research. The focus of the empirical aspects of this study was entirely based on the experiences of Ghanaian construction industry, and given that practical and professional experiences may differ across countries, geographical region or continent, it is entirely conceivable that there may be significant differences and variations in the findings if this study is replicated in other countries or geographical regions. However, theoretically, it can be said that the construction industry in many developing countries especially in sub-Saharan Africa are deemed to exhibit similar practical and professional characteristics. Hence, this limitation noted here does not undermine the validity of the research undertaken and potential application of its main findings in these developing countries. Additionally, the convergence of the findings with general body of knowledge and supported by the validation results further reinforce the credibility of the research findings.

It is very important to acknowledge the limitation which the relatively narrow population frame considered in the study imposes. Though limiting the sample frame to the project team leader assessing the overall communication ineffectiveness draws its theoretical strength from mainstream project management, management and human resource practice. It can be contended that practically, some related issues of communication ineffectiveness that happen deep among other members of the project team may not come to the attention of the team leaders. Additionally, various professionals may experience communication problems unique to their related tasks and core functions either than the team leaders. Hence expanding the sampling frame to have included all the project team participants on mass housing could have enriched the findings and increased its potential generalization. However, this not withstanding, this should not nullify the findings and conclusions as the demographic profile of the project team leaders show a cross fertilization of almost all the professionals on mass housing project team acting as team leaders. Additionally, the cross validation of the results in the model suggested that, indeed these findings are critical if communication on mass housing should be effective.

As hinted by Hair *et al.* (2014 & 2013) and Kline (2010) that most statistical analytical approach and tools are affected by issues of multicollinearity, sampling inconsistencies, measurement errors, analytical bias which are likely to impact on the results and the potential conclusions to be drawn from the findings. However, not withstanding the potential of these highlighted above, it can be suggested that the demographic profile of the respondents in experience, knowledge & understanding on the subject as well as the SEM estimation method and consistencies registered in the statistical analysis indicate some degree of reasonable credibility and trustworthiness in the results from the survey. For example, the ability of the Robust Maximum Likelihood estimation method in SEM to internally deal with the effects of non-normality and the rigorous process of fit statistics and test of significance enhances the credibility of the results realized.

9.7 RECOMMENDATIONS FOR PROFESSIONALS AND INDUSTRY

Given the widespread acknowledgement of the communication ineffectiveness on mass housing projects coupled with the need to instigate effective communication towards enhanced success and performance in mass housing delivery (Ahadzie *et al.*, 2014; Zairul and Rahinah, 2011; Ibem *et al.*, 2011), this study has provided some empirical revelation of the communication problems inherent in the unique nature of mass housing projects. Against this, some recommendations have thus been put forward to provide some direction for improvement in communication performance on MHPs as:

- Given the recognition that, management intuition on mass housing and its unique features require unique skills in its delivery (Ahadzie *et al.,* 2007), the findings generated can therefore help mass housing project professionals and practitoners to develop the core task and behavioural knowledge and skills related to communication to engender effective communication outcome on MHPs. This can be achieved both by training and continuous professional development. This recommendentaion is buttressed by the fact that, in mainstream human resource management, and administration in the business and manufacturing field, the recognition of frequent communication ineffectiveness in business organization led to the introduction of business communication as a mandatory course in training of business and management professionals. Anecdotally, it can be said that, this has afforded business and management professionals the opportunity to adopt, adapt and develop necessary communication knowledge, skills, strategies and approaches that are crucial towards enhanced communication in business organization and management. Unfortunately, in the training of construction industry professionals in Ghana and many developing countries, such an opportunity to acquire these skills and knowledge is absent. Hence these findings could be adopted to develop key communication skills and training that can engender effective communication in the industry.

- Additionally, the findings and its congruence with literature have cemented the unique attributes of mass housing in respect of repetitive tasks and housing units and its resultant potential towards standardization and uniformity in communication aided by ICT. Against this, the findings here presented are extremely significant for stakeholders to develop bespoke communication technology backbone necessary to standardize the communication tasks and functions on MHPs towards inducing effective communication among project teams and participants.

- Likewise, in order to increase the likelihood of enhanced communication effectiveness and its consequential benefit of managerial efficiency in mass housing delivery, there is the necessity for practitioners and stakeholders to advance these findings in their mass housing planning to make better and informed decisions at the early stages of the procurement, contract design and communication strategies to influence sound communication practices and outcome. In such account, the insight into the causal influence of the unique attributes of MHPs to communication performance could inform the priortising of communication protocols, procedures, media vis-a-viz it contraints among the team.

9.8 RECOMMENDATIONS FOR FURTHER RESEARCH

Issues of communication performance assessments and communication factors that influence it are said to be inexhaustive, hence any research will still leave other grey areas worth studying in the future. To this end, it is worth proposing further studies into the causal influence of the unique features and other factors on the communication process and outcome on mass housing projects. Such knowledge and new areas could complement the findings gained in this study towards engendering effective communication on mass housing projects and delivery success. Drawing on the research findings as well as the inherent limitations outlined, the following recommendations are put forward for future research:

- Given that the communication process involves several components such as medium, information etc. there is the need to conduct further studies to explore how these features influence the effectiveness of the medium used on mass housing project team communication.

- Also, it is well noted that, the conceptual and theoretical framework adopted identified two main factors (external and internal). The findings provided here focused on the external factors. Given the significance of the human behavioural competencies on communication outcome, it will be significant for further studies to be conducted to investigate the influence of the behavioural skills in the mass housing project environment.

- Here in this study, the focus was on the construction stage (phase) of the construction process. It is thus very important to carry out a longitudinal study across all the phases to build up a complete picture of the influence of the unique features from inception to completion on mass housing projects.

- In this study, the focus was on the overall communication ineffectiveness by the project team leaders. It will be very necessary to expand the study into the various specific inherent communication problems among the specific professional participants (say architect and engineer, project manager and contractor etc). Such inquiry could provide insight into practical and pinpoint measures for controlling the communication ineffectiveness associated with these features between the professionals.

- Theoretically, given the perceived conceptualized correlation between communication performance and project performance on construction projects (Ingason and Jónasson, 2009), there is also the need for further empirical studies to explore the impact of these communication problems on mass housing project performance. This is because efficient productive work environments critically depend on effective communication performance level among the productive task performers.

9.9 SUMMARY

Here in this chapter, a review of the original research objectives and how they were achieved have been provided. Likewise, the main conclusions addressing the research aim, the significant contribution made to knowledge and the limitations of the research have been made and acknowledged respectively. In summary, it can be emphasized that, given the significant role communication plays in project success and performance, the contribution of the unique nature of mass housing projects to project team communication ineffectiveness cannot be overlooked or ignored in the pursuit of engendering managerial efficiencies and communication effectiveness on mass housing projects. Hence, in the wake of the global acceptance of mass housing delivery as a paradigm to curtail the growing housing deficit by both governments and the private sector, the insight provided by this research presents a platform for mass housing stakeholders and practitioners to adopt and adapt to positively communicate effectively on mass housing projects.

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APPENDICES

APPENDIX 1

DEPARTMENT OF BUILDING TECHNOLOGY

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QSVY/l.2 **20th June, 2014**

Dear Sir/Madam,

SURVEY ON CONTRIBUTION OF UNIQUE FEATURES OF MASS HOUSING PROJECTS TO PROJECT TEAM COMMUNICATION PERFORMANCE

I write to humbly elicit your participation to complete the attached questionnaire on a Doctor of Philosophy (PhD) research on the topic *Contribution of the Unique Features of Mass Housing Projects to Project Team Communication Performance*. This is an on-going research under the supervision of Rev. Dr. Frank Fugar and Dr. Emmanuel Adinyira from the Department of Building Technology, Kwame Nkrumah University of Science and Technology- Kumasi.

The study seeks to draw on your experience from your involvement as the leader of the Mass housing project team in your Real Estate organization to assess the influence of the unique nature of mass housing on the communication performance among the project team that manages and delivers the housing units. The expected outcome of the research is to help provide a comprehensive model for evaluating communication performance of the project team towards managerial efficiency and communication effectiveness on future Mass housing projects (MHPs).

Should you have any queries on the attached questionnaire, please do forward them to any of the following details: Titus Ebenezer Kwofie (tekwofie.cap@knust.edu.gh, Phone: 0244721622), Rev. Dr. Frank Fugar (fdkfugar.cap@knust.edu.gh, Phone: 0242357550) and Dr. Emmanuel Adinyira (eadinyira.feds@knust.edu.gh, Phone: 0246753214The questionnaire takes about ***30 minutes*** (on average) to complete. We also assure you that all responses and contribution to the study will be treated strictly confidential.

Your responses will be an immense contribution to the success of the study and its further outcome to the overall mass housing industry. We are also willing to share the outcome of the research with the major stakeholders of the Real Estate Industry and academia as a whole.

Accept our appreciation for your contribution to this research.

Yours faithfully

Titus Ebenezer Kwofie, Doctor of Philosophy- (Building Technology) Candidate
Department of Building technology, KNUST-Kumasi
Tel: 024-4721622
E-mail: tekwofie.cap@knust.edu.gh or teeagk@yahoo.co.uk

PARTS OF THE QUESTIONNAIRE

The questionnaire consists of four main sections. The first part is **Section A,** and this requests for the background and experience of the respondent in Mass Housing Projects delivery. **Sections B, C and D** on the other hand cover the main objectives of the study. That is to respond to the perceived level of contribution of the *Unique Features* on the Communication Performance among Mass Housing Project Team.

SECTION A: **BACKGROUND INFORMATION**

Experience:

1) What is your profession in the project team?

………………………………………………

2) As the Project Team (PT) leader, please indicate your educational qualification?

………………………………………………

3) Please indicate the composition of your project team including their profession and qualification?

☐ Project Manager ☐ Architect ☐ Quantity Surveyor ☐ Civil Engineer ☐ Services Engineer

☐ Main Contractor ☐ Sub-Contractor Others specify: ………………………………………………………………

4) What is the typical management system adopted by your project team on the housing scheme you managed?

☐ Traditional Method ☐ Construction Management ☐ Contract Management ☐ Project Management System

Others specify: ……………………………………………………………………………………………………….

5) How long have you been involved/participated in Mass Housing Development?

☐ Up to 5years ☐ 6-10 years ☐ 11-15 years ☐ 16 years and above

6) How long has your organization been involved in Mass Housing projects?

☐ Up to 5yrs ☐ 6-10years ☐ 11-15years ☐ 16- 20 years ☐ 21years and above

7) What is the maximum number of housing units you have managed per single housing scheme at one location?

☐ Up to 25 units ☐ 26-50 units ☐ 51-75 units ☐ 75- 100 units ☐ 101 and above

8) Please indicate the average size in m^2 of the scheme in (7) above.

………………………………………..

SECTION B: EFFECTIVENESS OF PROJECT TEAM COMMUNICATION PERFORMANCE ON MHPs

Considering your position as the Leader of the Project Team (PT), please indicate the ***frequency*** of the following communication problems among the Mass Housing Project Team (PT) at the construction stage as indicated in the statements below. The response scale is as follows:

1. Never 2. Rarely 3. Occasionally 4. Frequently 5. Very Frequently

S /No.	COMMUNICATION PERFORMANCE INDICATORS	Level of Frequency				
		1	2	3	4	5
PCE1	Persistent change in content of communicated information					
PCE2	**Lack of consistency in communicated information leading to lack of coordination among project team**					
PCE3	***Receiving less information than expected from team participants for tasks***					
PCE4	**Persistent change in meaning of communicated information**					
PCE5	Lack of conciseness in communicated information among the project team					
PCE6	**Lack of clarity in communicated information resulting in different interpretations**					
PCE7	***Late delivery of needed communicated information***					
PCE 8	**Misunderstanding of communicated information**					
PCE 9	**Receiving conflicting information from team participants**					
PCE 10	Receiving more information than necessary for the tasks					
PCE 11	Lack of coherency in communicated information resulting in different interpretations					
PCE 12	Witholding of part of the information by the one who controls communication					
PCE 13	***Difficulty in disseminating information among project team***					
PCE 14	***Difficulty in accessing communicated information from channels***					
PCE 15	Witholding of whole of the information by the one who controls communication					
PCE 16	**Lack of defined roles and responsibilities among members of the team leading to communication failure**					

SECTION C: CONTRIBUTION OF THE UNIQUE FEATURES ON MASS HOUSING PROJECT TEAM COMMUNICATION PERFORMANCE

Please indicate the ***significance or otherwise*** of the following unique features of Mass Housing projects (MHPs) on the project team communication performance on MHP by ticking the appropriate box. The response scale is as follows:

1. Very insignificant 2. Insignificant 3. Averagely Significant 4. Significant 5. Very significant

S /No.	UNIQUE FEATURES OF MASS HOUSING PROJECTS	Level of Significance				
		1	2	3	4	5
MCS	**MULTIPLE CONSTRUCTION SITES MANAGEMENT STYLE**					
MCS1	Contractor management style adopted on housing units under scheme					
MCS2	Site management style adopted on the housing units under scheme					
MCS3	Construction technology and method adopted for repetitive works in housing units under scheme					
MCS4	Change orders (Variation Orders) procedures adopted on repetitive housing units under scheme					

MCS5 Health and safety management techniques adopted for repetitive task construction works on housing units under scheme

MCS6 Computer application software(s) adopted by project teams on housing units under scheme

MCS7 Quality Management style and approach adopted on housing units and overall scheme(s)

HDP **HOUSING UNIT DESIGN AND CONTRACT PACKAGING**

HDP1 Composition of housing design in each contract packages under housing scheme

HDP2 Construction elements and components adopted in design units in contract packages under scheme

HDP3 Packaging of 'one-off' infrastructure' e.g water, electricity, road etc on housing units under scheme

HDP4 Contractual arrangement on 'one-off' infrastructure' e.g water, electricity, road etc on housing units under scheme

HDP5 Packaging of 'Preliminaries items' adopted under standardised repetitive housing units under scheme

HDP6 Contract Type adopted for Preliminary items

MGL **MULTIPLE GEOGRAPHICAL LOCATION FOR VARIOUS SCHEMES/CONTROL**

MGL1 Influence of Local Development Controls across different geographical locations on housing units under scheme

MGL2 Cultural influence within labour work force due to geographical locations

MGL3 Influence of customary laws and practices on the tennural lands under scheme in various geographical locations

MGL4 Geographical constraints and challenges due to location influence on repetitive works and housing delivery

NPS **NETWORK OF PROCUREMENT SYSTEMS**

NPS1 *Labour contracting style on housing units under*

NPS2 Project team composition adopted on the housing scheme under management (eg. only inhouse team or in-house and external professionals (mixed)

NPS3 Construction material procurement style adopted on the housing scheme.

NPS4 Subcontracting style adopted across housing units under scheme

NPS5 Control, monitoring and coordination style in subcontracting on housing units under housing scheme

NPS6 *'Prospective Buyer'* involvement in the construction process under scheme

RDS **REPETITIVE TASKS MANAGEMENT DELIVERY STRATEGY**

RDS1 Labour management techniques adopted for standardised repetitive construction works on schemes

RDS2	Cost saving management techniques adopted for standardised repetitive construction works					

on housing units under scheme

RDS3 Project delivery times adopted for various housing units under the scheme
RDS4 Repetitive Task delivery scheduling concept adopted on various housing units
RDS5 Contractual relationship adopted among project team
RDS6 Reporting styles adopted for Project Team (PT) communication
RDS7 Dissemination protocols adopted for Project Team (PT) communication
RDS8 Information documentation style adopted among team on housing units under scheme(s)

SECTION D: NATURE OF CONTRIBUTION OF THE UNIQUE FEATURES ON MASS HOUSING PROJECT TEAM COMMUNICATION PERFORMANCE

How often on a scale of 1-5 does each of the following indicators of communication ineffectiveness (A-I) occur because of the ***unique features*** of Mass Housing.

A. Inaccurate information B. Late information C. Distorted information D. Difficulty in accessing information E. Misunderstanding information F. Incomplete information G. Held back information
H. Excess information than needed I . Difficulty in dissemination Procedures and protocols

The response scale is as follows from 1-5:

1. Never 2. Rarely 3. Occasionally 4. Frequently 5. Very Frequently

S /No.	UNIQUE FEATURES OF MASS HOUSING PROJECTS	Frequency Level
MCS	MULTIPLE CONSTRUCTION SITES MANAGEMENT STYLE	A
	Contractor adopting uniform management style on all housing units under scheme	
	Adopting uniform site management style on all housing units under scheme	
	Adopting uniform construction technology and method for repetitive works in all housing units under scheme	
HDP	HOUSING UNIT DESIGN PACKAGING	

Adopting single standardized design-units in one *contract package*

Adopting different standardized design-units in one *contract package*
Adopting uniform 'preliminaries items' packaging under same standardised housing units under scheme

Undertaking 'one-off' infrastructure' e.g water, electricity, road etc under single contract package under housing scheme

MGL **MULTIPLE GEOGRAPHIC LOCATION FOR VARIOUS SCHEMES**

Housing scheme under the influence of different Local Development Controls and *'bye-laws'*

Housing scheme under the influence of single local Development Controls and '*bye-laws'*

NPS **COMPLEX NETWORK OF PROCUREMENT SYSTEMS**

Adopting only in-house labour on housing units under scheme
Adopting a mix of in-house and external labour on housing units under scheme

Adopting only external labour on housing units under scheme

Adopting a Project Team (PT) involving only 'in-house' professionals to manage the housing scheme

Adopting a Project Team (PT) involving a mix of 'in-house' and externally engaged professionals to manage the housing scheme

Adopting a Project Team (PT) involving only externally engaged professionals outside the mass housing company to manage the housing scheme The involvement of 'prospective buyers' in the construction process

RDS DELIVERY TIME FOR VARIOUS INDIVIDUAL DESIGN-HOUSE UNITS UNDER SCHEMES

Adopting firm project duration (time scales) on the scheme

Adopting flexible project duration (time scales) on the scheme

Adopting uniform information dissemination protocol among team on housing units under scheme

B C D E F G H I

APPENDIX 1A

Multiple Construction Sites Management Style (MCS) Factor

RESIDUAL COVARIANCE MATRIX (S-SIGMA): UNSTANDARDIZED

AVERAGE ABSOLUTE RESIDUAL = 0.0066
AVERAGE OFF-DIAGONAL ABSOLUTE RESIDUAL = 0.0109

STANDARDIZED RESIDUAL MATRIX:

AVERAGE ABSOLUTE STANDARDIZED RESIDUAL = 0.0137
AVERAGE OFF-DIAGONAL ABSOLUTE STANDARDIZED RESIDUAL = 0.0228

Housing Unit Design Contract Packaging (HDP) Factor

RESIDUAL COVARIANCE MATRIX (S-SIGMA) : UNSTANDARDISED

AVERAGE ABSOLUTE COVARIANCE RESIDUALS = .0109
AVERAGE OFF-DIAGONAL ABSOLUTE COVARIANCE RESIDUALS = .0182

STANDARDIZED RESIDUAL MATRIX:

AVERAGE ABSOLUTE STANDARDIZED RESIDUALS = .0175
AVERAGE OFF-DIAGONAL ABSOLUTE STANDARDIZED RESIDUALS = .0292

Multiple Geographical Location for Various Schemes (MGL) Factor

RESIDUAL COVARIANCE MATRIX (S-SIGMA) : UNSTANDARDISED

AVERAGE ABSOLUTE COVARIANCE RESIDUALS = .0102
AVERAGE OFF-DIAGONAL ABSOLUTE COVARIANCE RESIDUALS = .0171

STANDARDIZED RESIDUAL MATRIX:

AVERAGE ABSOLUTE STANDARDIZED RESIDUALS = .0172
AVERAGE OFF-DIAGONAL ABSOLUTE STANDARDIZED RESIDUALS = .0286

Complex Network of Procurement Systems (NPS) Factor

RESIDUAL COVARIANCE MATRIX (S-SIGMA) :

AVERAGE ABSOLUTE COVARIANCE RESIDUALS = .0021
AVERAGE OFF-DIAGONAL ABSOLUTE COVARIANCE RESIDUALS = .0035

STANDARDIZED RESIDUAL MATRIX:

AVERAGE ABSOLUTE STANDARDIZED RESIDUALS = .0045 AVERAGE OFF-DIAGONAL ABSOLUTE STANDARDIZED RESIDUALS = .0076

Repetitive Tasks Management Delivery Strategy (RDS) Factor

RESIDUAL COVARIANCE MATRIX (S-SIGMA) :

AVERAGE ABSOLUTE COVARIANCE RESIDUALS = .0097
AVERAGE OFF-DIAGONAL ABSOLUTE COVARIANCE RESIDUALS = .0145

STANDARDIZED RESIDUAL MATRIX:

AVERAGE ABSOLUTE STANDARDIZED RESIDUALS = .0194
AVERAGE OFF-DIAGONAL ABSOLUTE STANDARDIZED RESIDUALS = .0291

Project Team Communication Performance (PCE) Factor (Information Flow)

RESIDUAL COVARIANCE MATRIX (S-SIGMA) :

AVERAGE ABSOLUTE COVARIANCE RESIDUALS = .0055
AVERAGE OFF-DIAGONAL ABSOLUTE COVARIANCE RESIDUALS = .0091

STANDARDIZED RESIDUAL MATRIX:

AVERAGE ABSOLUTE STANDARDIZED RESIDUALS = .0146
AVERAGE OFF-DIAGONAL ABSOLUTE STANDARDIZED RESIDUALS = .0244

Project Team Communication Performance (PCE) Factor (Information Composition)

RESIDUAL COVARIANCE MATRIX (S-SIGMA) :

AVERAGE ABSOLUTE COVARIANCE RESIDUALS = .0091
AVERAGE OFF-DIAGONAL ABSOLUTE COVARIANCE RESIDUALS = .0137

STANDARDIZED RESIDUAL MATRIX:

AVERAGE ABSOLUTE STANDARDIZED RESIDUALS = .0183 AVERAGE OFF-DIAGONAL ABSOLUTE STANDARDIZED RESIDUALS = .0274 MODEL 2.0 RESIDUAL COVARIANCE MATRIXES (S-SIGMA)

Residual covariance matrix for the full structural model (Unstandardized)Information Flow

25-Nov-14 PAGE : 7 EQS Licensee:

TITLE: Model built by EQS 6 for Windows

MAXIMUM LIKELIHOOD SOLUTION

AVERAGE ABSOLUTE COVARIANCE RESIDUALS = .0484

AVERAGE OFF-DIAGONAL ABSOLUTE COVARIANCE RESIDUALS = .0522

25-Nov-14 PAGE : 8 EQS Licensee:

TITLE: Model built by EQS 6 for Windows

MAXIMUM LIKELIHOOD SOLUTION

STANDARDIZED RESIDUAL MATRIX:

AVERAGE ABSOLUTE STANDARDIZED RESIDUALS = .0559

AVERAGE OFF-DIAGONAL ABSOLUTE STANDARDIZED RESIDUALS = .0638

MODEL 2.1 RESIDUAL COVARIANCE MATRIXES (S-SIGMA)

Residual covariance matrix for the full structural model (Unstandardized)-Information Composition

25-Nov-14 PAGE : 6 EQS Licensee:

TITLE: Model built by EQS 6 for Windows

MAXIMUM LIKELIHOOD SOLUTION (NORMAL DISTRIBUTION THEORY)

PARAMETER ESTIMATES APPEAR IN ORDER,

NO SPECIAL PROBLEMS WERE ENCOUNTERED DURING OPTIMIZATION.

AVERAGE ABSOLUTE COVARIANCE RESIDUALS = .0501

AVERAGE OFF-DIAGONAL ABSOLUTE COVARIANCE RESIDUALS = .0535

25-Nov-14 PAGE : 7 EQS Licensee:

TITLE: Model built by EQS 6 for Windows

MAXIMUM LIKELIHOOD SOLUTION

STANDARDIZED RESIDUAL MATRIX:

```
AVERAGE ABSOLUTE STANDARDIZED RESIDUALS     =         .0611 AVERAGE OFF-
       DIAGONAL ABSOLUTE STANDARDIZED RESIDUALS     =.0814 BENTLER-WEEKS
            STRUCTURAL REPRESENTATION: Full Model 2.0 (Information Flow)

NUMBER OF DEPENDENT VARIABLES = 26
    DEPENDENT V'S :    15   18   20   21   23   24   25   26   27   28
    DEPENDENT V'S :    29   30   31   32   33   34   35   36   37   38
    DEPENDENT V'S :    39   40   41   42   43
    DEPENDENT F'S :     1

NUMBER OF INDEPENDENT VARIABLES = 31
    INDEPENDENT F'S :     2    3    4    5    6
    INDEPENDENT E'S : 15   18   20   21   23   24   25   26   27   28
  INDEPENDENT E'S :    29   30   31   32   33   34   35   36   37   38
    INDEPENDENT E'S :    39   40   41   42   43
    INDEPENDENT D'S :     1

NUMBER OF FREE PARAMETERS =  55
NUMBER OF FIXED NONZERO PARAMETERS =  32


BENTLER-WEEKS STRUCTURAL REPRESENTATION: Full Model 2.1 (Information
Composition)

NUMBER OF DEPENDENT VARIABLES = 27
    DEPENDENT V'S :    14   16   17   19   22   23   24   25   26   27
    DEPENDENT V'S :    28   29   30   31   32   33   34   35   36   37
    DEPENDENT V'S :    38   39   40   41   42   43
    DEPENDENT F'S :     1

NUMBER OF INDEPENDENT VARIABLES = 32
    INDEPENDENT F'S :     2    3    4    5    6
    INDEPENDENT E'S :    14   16   17   19   22   23   24   25   26   27
    INDEPENDENT E'S :    28   29   30   31   32   33   34   35   36   37
    INDEPENDENT E'S :    38   39   40   41   42   43
    INDEPENDENT D'S :     1

NUMBER OF FREE PARAMETERS =  57
NUMBER OF FIXED NONZERO PARAMETERS =  33
```

APPENDIX 2

DEPARTMENT OF BUILDING TECHNOLOGY
COLLEGE OF ARCHITECTURE AND PLANNING
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VAL/TEK/l.4 **16th January, 2015**

Dear Sir/madam

VALIDATION OF AN EVALUATIVE MODEL ON CONTRIBUTION OF UNIQUE FEATURES OF MASS HOUSING PROJECTS TO PROJECT TEAM COMMUNICATION PERFORMANCE

BACKGROUND:

Communication ineffectiveness inherent from the impact of the unique features of mass housing project (MHPs) is reported to be prevalent in the housing industry. Against this, a study was undertaken which aimed at developing an evaluative model for assessing the contribution of the unique features of MHPs to the communication ineffectiveness among the project team.

From this study, two evaluative communication performance models have been developed which identifies the unique features of mass housing projects that significantly contribute to the overall communication ineffectiveness (problems) among the project team. The two models evaluate the communication problems inherent from the flow and composition of project related information respectively.

MAJOR FINDINGS:

From the research, the following unique features have been identified to significantly contribute to information flow and information composition ineffectiveness in the communication among the project team:

Multiple Construction Sites Management Style (MCS)

Housing Unit Design Contract Packaging (HDP)

Multiple Geographical Locations for Various Schemes (MGL)

Network of Procurement Systems (NPS) and

Repetitive Tasks Management Delivery Strategy (RDS)

These are presented in the two models in Figures 1.0 & 2.0.

RATIONAL:

Inherent from the need to tackle the communication problems induced by the unique attributes of MHPs to engender managerial efficiencies and communication effectiveness in mass housing delivery, the significance of these findings cannot be ignored. One of the key steps towards registering improved communication effectiveness in the mass housing delivery is to develop and evolve strategies that adapt to the project environment. Central to achieving this requires detailed understanding and knowledge on the nature of contribution of the MHP attributes and environment to the communication performance outcome. Against this, it is intended to consolidate the research findings into a communication management tool kit in the future that will be beneficial to mass housing practitioners and stakeholders towards evaluating and improving communication on mass housing projects. This will aid in developing and adapting relevant skills, strategies and planning techniques towards communication on MHPs.

EXPLANATION:

The following explanations have been offered to give understanding of the key concepts and relationship among the variables contained in the respective models. Here in this study, the term information flow communication refers to the delivery of shared information from its original setting (senders) to its end users (receivers) through the accepted medium among the project team. Information composition on the other hand refers to the crafting and processing of related information that is shared through the medium among project team. The acronym PCE used in the models stands for the measure of the communication performance outcome in relation to information flow and information composition. In the respective models, the arrows show and measure the directional influence of each of the unique features (MCS, HDP, MGL, NPS and RDS) on the project team communication effectiveness (PCE). The sub variables (e.g. PCE1, 2 etc, MCS1, 2 etc) define the various main factors.

Against this background, your input is being elicited in validating the findings as well as help to establish the potential relevance of the findings to the industry through a validation questionnaire. The questionnaire is structured into three main sections with the first two sections each focusing on the respective models. The third section is on the importance of the findings of the study. Your cooperation and input are very much appreciated.

Thank You Very much.

Titus Ebenezer Kwofie (PhD Student) teeagk@yahoo.co.uk

(024-4721622)

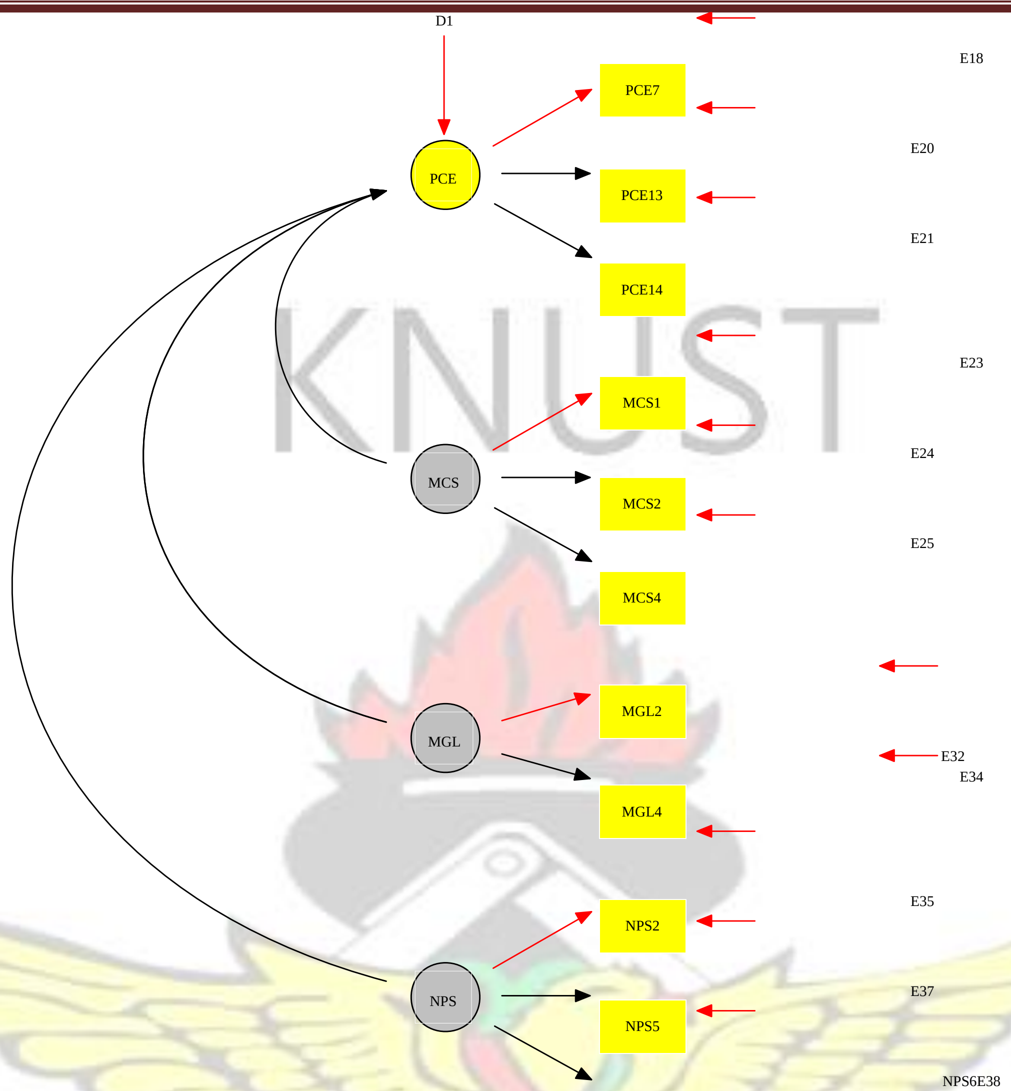

Figure 1.0: Evaluative Information Flow Communication Ineffectiveness model

SECTION ON INFORMATION FLOW MODEL

Please indicate the extent to which you agree to the following features to significantly influence information flow communication ineffectiveness among the mass housing project team.

The response scale is as follows:

1. Strongly Disagree 2. Disagree 3. Neutral 4. Agree 5. Strongly Agree

S /No.	UNIQUE FEATURES OF MASS HOUSING PROJECTS	Level of Importance				
		1	2	3	4	5
MCS	Multiple Construction Sites Management Style Features					
MGL	Multiple Geographical Location for Various Schemes/Control Features					

NPS	Network of Procurement Systems Features					

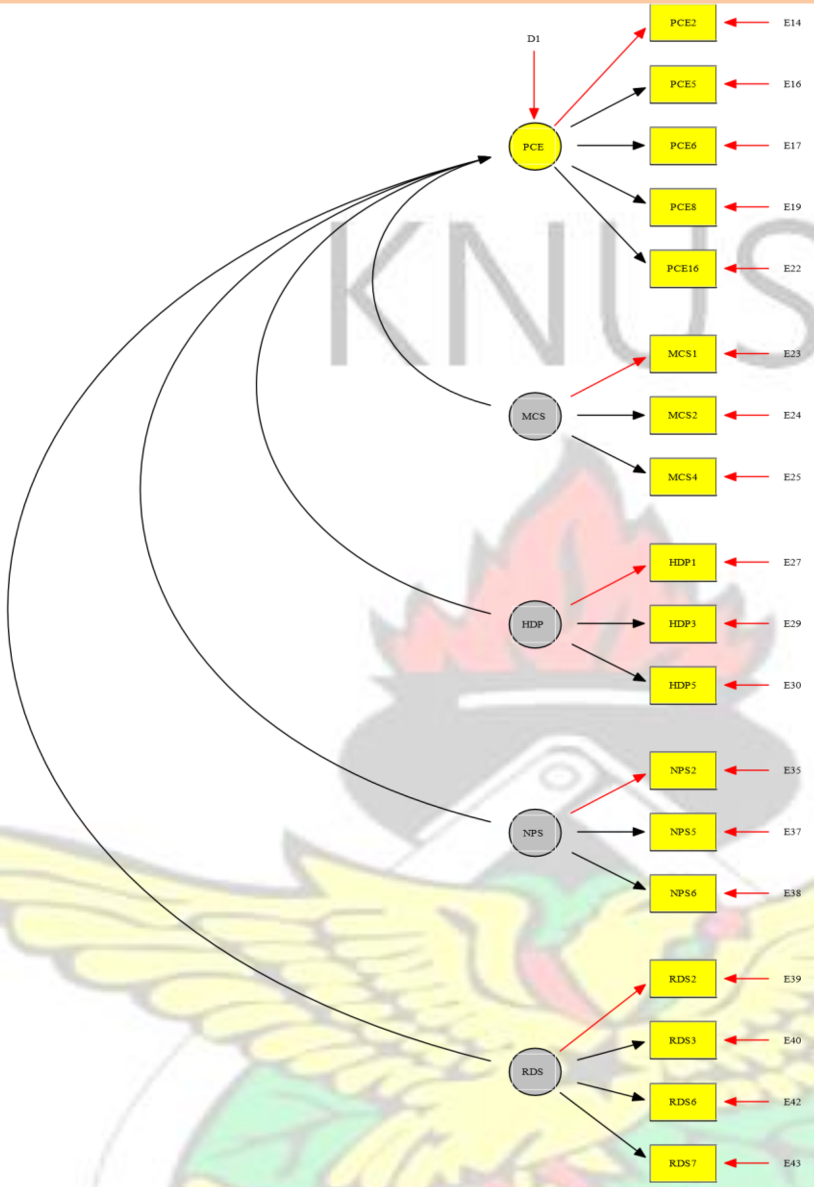

Figure 2.0: Evaluative Information Composition Communication Ineffectiveness model

SECTION ON INFORMATION COMPOSITION MODEL

Please indicate the extent to which you agree to the following features to significantly influence information composition communication ineffectiveness among the mass housing project team.

The response scale is as follows:

1. **Strongly Disagree 2. Disagree 3. Neutral 4. Agree 5. Strongly Agree**

S /No.	UNIQUE FEATURES OF MASS HOUSING PROJECTS	Level of Importance				
		1	2	3	4	5
MCS	Multiple Construction Sites Management Style Features					

HDP	Housing Unit Design Contract Packaging Features					
NPS	Network of Procurement Systems Features					
RDS	Repetitive Tasks Management Delivery Strategy Features					

SECTION ON THE SIGNIFICANCE OF THE FINDINGS

IMPORTANCE AND POTENTIAL APPLICATIONS OF THE FINDINGS TO IMPROVE MASS HOUSING COMMUNICATION

Considering the aim and findings of the research, please indicate the extent to which you perceive the findings as very relevant to improving the management of mass housing development on a five point scale interpreted as:

The response scale is as follows:

1. Not Very Important 2. Not Important 3. Neutral 4. Important 5. Very Important

S /No.	POTENTIAL APPLICATION AND IMPORTANCE OF FINDINGS	Level of Importance				
		1	2	3	4	5
Please indicate the extent of importance you perceive the findings as practically important and applicable to the following areas towards improving mass housing communication effectiveness and managerial efficiencies						
1	Mass housing communication planning and management					
2	Training of Mass Housing professionals					
3	Communication technology infrastructure on Mass housing projects					
4	Improving Contract designs and packaging on MHPs					
5	Developing Communication Course curriculum for Construction professionals					
6	Mass Housing Team selection and composition					

4. Please indicate suggestions for any other future application.

………

………

………

………

………