

**DETERMINANTS OF QUALITY DELIVERY OF DESIGN-BUILD
PROJECTS: A CASE OF SMALL-SIZE HOUSING PROJECTS IN
KASARANI CONSTITUENCY, NAIROBI, KENYA**

**BY
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Award of the Degree of Master of Arts in Project Planning and Management of the University
of Nairobi**

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DECLARATION

This research project report is my original work and has never been presented for the award of any degree in any university.

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DEDICATION

This research projectreport is dedicated to my wife Olycent, parents Rehema and Juma and my siblings Razick, Saida, Mariam, Otayo and Khalid for their support, belief and constant presence during my studies.

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ABBREVIATIONS AND ACRONYMS

AIA-American Institute of Architect

BIM- Building Information Modeling

CE- Concurrent Engineering

CNC- Computer Numerical Control

IFOA- Integrated Form of Agreement

IPD- Integrated Project Delivery

NCA- National Construction Authority

SALA- School of Architecture and Landscape Architecture

SCRI- Centre for Research and Innovation

UN- United Nations

Abstract

The UN-HABITAT estimates that 3 billion people will be in need of proper housing by 2030 while the National Construction Authority (NCA) reports that 70% of houses in Nairobi are unsafe for occupation. The foreseen housing safety and shortage problems will particularly affect urban centers, because of the apparent increasing preference for urban life. Currently, 32% people, representing 2.5 billion of the world population, live in unsafe houses in slums. This deplorable housing situation is caused and characterized by unfinished or poorly finished housing projects, poor workmanship, poorly planned and uncoordinated housing project implementation, which result in unsafe, uninhabitable and unsatisfactorily built houses. In addition, the use of traditional approach to housing project delivery, which is commonplace in small project teams, has really contributed to outgrown project costs and prolonged project time because of slower pace. The purpose of this study was to establish the factors that influence the quality delivery of small-size design-build housing projects in Kasarani Constituency, which reports quite high numbers of unsafe and collapsed houses in Nairobi County. The objectives of the study are; to establish the influence of collaborative participation, concurrent project processes, transparency, object-oriented technology and risk-sharing on the quality delivery of small-size housing projects in Kasarani Constituency, Nairobi. The study design used is cross-sectional survey in which data was obtained using questionnaires from a sample size of 60, obtained from a target population of 70 construction project stakeholders in Kasarani Constituency. The sample consisted of project owners, contractors, subcontractors, engineers, suppliers and workers. The data was analyzed using descriptive statistics and Spearman's Rho statistical tests to show the influence of the independent variables on the dependent variable and their relationship. Hopefully, this study will be significant in outlining the factors that promote the delivery of quality or safe houses that meet client expectations. It may also be used by the housing industry and governments to achieve urbanization and housing policy goals such as the housing and urbanization objectives of the Kenyan Government's Vision 2030 initiative. The study established positive relationships, albeit to different degrees between the independent variables; collaborative participation, concurrent project processes, object-oriented technology and risk-sharing, and the dependent variable; quality delivery of small-size design-build housing projects in Kasarani Constituency, Nairobi County. Finally, it is recommended that, for the stakeholders in the small-size housing sector to deliver projects within the quality, budget, time and scope specifications, there is need for the adoption of an integrated project delivery (IPD) approach and modern and effective technologies such as Building Information System, CAD, 4D and 3D designs. In addition, a culture of collaborative participation, risk management and transparency ought to be embraced to promote integration in project delivery.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Across the world, unfinished or poorly finished housing projects litter urban centres. Several factors contribute to this poor workmanship on projects. Though all types of housing projects face challenges of poor planning, uncoordinated implementation, operationalization and sustainability issues, small-size housing projects or programmes face more serious delivery challenges. The main causes of housing challenges in developing countries are insufficient political will, lack of local ownership and leadership, inadequate and limited housing finance mechanisms, security tenure and lack of promotion of rental housing options.

These challenges result in the delivery of houses that are not only uninhabitable but also fall short of eliciting owners' and users' satisfaction. Often, by the time such projects are completed, the unit cost has grown and the stipulated construction time is already elapsed (Stagner, 2008). Moreover, there is often non-conformance to owner's specifications and expectations. Hence, owners, clients and users are not satisfied. The poor delivery of small size housing projects has enormous impacts on housing. Key among the impacts of poor housing project delivery is shortage of houses or the use of substandard houses in most world urban centres (Bhatta, 2010).

According to the United Nations (UN), Housing crisis is a global phenomenon with about 1.6 billion people living in substandard houses whereas about 100 million remain homeless in the 21st century (UN-HABITAT, 2003). Currently, UN-HABITAT estimates that 3 billion people will lack proper housing by 2030. The crisis is worsened by the fact that people increasingly prefer urban life to rural life (Bhatta,

2010). This trend is particularly evident in the developing world. Globally, 32% of the world urban populations live in slums (UN-HABITAT, 2003). If no immediate and effective action is taken, in the next 20-30 years, more than 2 billion people will be living in slums (UN-HABITAT, 2003). In the USA, 95 million people, representing one third of the nation, have housing problems. Elsewhere in the world, people live in inadequate housing.

The United Nations undertook a study, dubbed the 'Istanbul Review' in 2001 in which it established that many countries had formulated comprehensive housing policies and strategies. The key purpose of most of these strategies is the development of a framework within which realistic housing projects would be implemented. Unfortunately, the policy and strategy documents have not been turned into action (Mulliner, Maliene&Maliene, 2013).

In Kenya's major urban centres such as Nairobi, Mombasa, Kisumu, Nakuru and Eldoret, shortage of residential and commercial houses continues to be a huge challenge for private and corporate citizens and the county and national governments (UN-HABITAT, 2003). The housing challenges got more complex after the promulgation of the new Constitutions in August 2010 and the 2013 general elections, which heralded the devolved form of government. In particular, Nairobi, the capital city of Kenya, has to grapple with numerous housing challenges, not necessarily restricted to urban housing shortages. Besides housing shortages, the small-size housing development sector in Nairobi faces the challenge of poorly delivered projects, characterized by collapsed houses and litigations among contractors, engineers, owners and consultants on non-compliance with contract requirements (UN-HABITAT, 2003) In many of these litigations, the contentious issues mainly relate to parties failing to meet their side of the contract (Hendrickson, 2008).

In June 9th-10th, 2003, UN-HABITAT organized a workshop on ‘Urban Housing Challenges and Opportunities in Developing Countries.’ The workshop was organised because of the realization that urbanization and housing challenges should be priority for African cities that were undergoing comprehensive transition. Considering the prospects that the population of Kenyan urban centres would have increased from 10 million to 21.7 million by 2010, policymakers already had an idea of the future housing troubles (UN-HABITAT, 2003).

A walk in most of Nairobi’s estates reveals that quite many housing projects are either stalled or built to substandard and uninhabitable forms. Hence, these structures are not only an eyesore but also contribute to the housing problems (shortages and collapsed buildings) in the city.

1.2 Statement of the Problem

According to the National Construction Authority (NCA), more than 70% of buildings in Nairobi are unsafe for occupation (NCA, 2015). Kasarani and Embakasi constituencies report the highest numbers of unsafe and collapsed houses (NCA, 2015). In an article in the Star Newspaper on Wednesday 28th January 2015, the NCA listed poor and uncoordinated workmanship, lack of adherence to construction regulations, lack of professional input and the use of substandard materials, and processes and technologies as the main causes of unsafe buildings in Nairobi (NCA, 2015). Other causes of unsafe houses in Nairobi are lack of risk management, lack of transparency and separate or disjointed project processes and activities.

According to the UN-HABITAT (2003), poor approaches to project delivery by owners, consultants, contractors and engineers also result in unsafe houses. Often, these stakeholders are not conversant with standardized project delivery

approaches and just adopt a casual approach to project inception, implementation and operationalization. In most cases, the traditional approach to project delivery is used, implying that many small-size housing projects in Kasarani Constituency are rarely structured. This practice is a recipe for projects stalling or entirely collapsing.

Most small-size housing project owners pay no attention to the important decision of how to structure a project. Instead, they prefer to use an approach to which they are familiar. Worse still, many small-size housing project owners follow their contractors, partners and consultants' recommendations blindly. The moment an owner settles for any suggested approach to project delivery, he or she loses the ability to influence the activities, processes, the implementation and the outcome of the project. Consequently, significantly more expenses are incurred in the traditional approach to project delivery (UN-HABITAT, 2003). In addition, the project lasts longer than was expected while the user and the client are unsatisfied. In the case of Kasarani Constituency's small-size housing projects, the use of traditional approach to delivery accounts for most of the collapsed and poorly delivered projects (National Construction Authority, 2015).

Many project owners, contractors, engineers and consultants in Kasarani Constituency are not conversant with the variety of housing construction project delivery approaches currently available for use (Lidonga, 2015). Only knowledgeable and confident owners and contractors have taken advantage of the more effective delivery methods such as the IPD to realise considerable success in delivering projects in the competitive construction market (Lidonga, 2015). In fact, a good number of small-size housing project owners have abandoned the traditional approach to project delivery and have since embraced the Integrated Project Delivery (IPD)

approach(Lidonga, 2015). These cases offer an insight into the influences of the IPD approach compared to the traditional approach to project delivery.

1.3 Purpose of the Study

The purpose of this study is to investigate the factors that influence the quality delivery of small-size design-build housing projects in Kasarani Constituency, Nairobi County, Kenya.

1.4 Objectives of the Study

To achieve its purpose, the study set out to achieve the following objectives

1. To establish the influence of object-oriented technology use on the quality delivery of small-size design-build housing projects in Kasarani Constituency, Nairobi County
2. To determine the influence of collaborative participation on the quality delivery of small-size design-build housing projects in Kasarani Constituency, Nairobi County
3. To determine the influence of concurrent project processes on the quality delivery of small-size design-build housing projects in Kasarani Constituency, Nairobi County
4. To establish the influence of transparency on the quality delivery of small-size design-build housing projects in Kasarani Constituency, Nairobi County
5. To determine the influence of risk-sharing on the quality delivery of small-size design-build housing projects in Kasarani Constituency, Nairobi County

1.5 Research Questions

The following questions were answered towards the achievement of the study's objectives

1. To what extent does object-oriented technology influence the quality delivery of small-size design-build housing projects inKasarani Constituency?
2. How does collaborative project participation influence the quality delivery of small-size design-build housing projects inKasarani Constituency?
3. To what extent do concurrent project processes influence the quality delivery of small-size Design-Build housing projects in Kasarani Constituency?
4. To what extent does transparency influence the quality delivery of small-size Design-Build housing projects in Kasarani Constituency?
5. To what extent does risk-sharing influence the quality delivery of small-size design-build housing projects in Kasarani Constituency?

1.6 Research Hypotheses

H₁1There is significant relationship between object-oriented technology and the quality delivery of small-size design-build housing projects in Kasarani Constituency

H₁2There is significant relationship between Collaborative project participation and the quality delivery of small-size Design-Build housing projects in Kasarani Constituency

H₁3There is significant relationship between concurrent project processes and the quality delivery of small-size design-build housing projects in Kasarani Constituency

H₁4 There is significant relationship between transparency and the quality delivery of small-size design-build housing projects in Kasarani Constituency

H₁₅ There is significant relationship between risk-sharing and the quality delivery of small-size design-build housing projects in Kasarani Constituency

1.7 Significance of the Study

The significance of this study is double-pronged. First, this study sought to establish the factors that influence the quality delivery and safety of small-size design-build housing projects in Nairobi County's Kasarani Constituency. Through this study, small-size housing project owners, contractors, sub-contractors, consultants and engineers might recognise and appreciate the need to shift from the traditional approach to the more modern approach, which ensures quality delivery, thus promoting product safety. Once stakeholders adopt such an approach, projects may be delivered within the time, cost, quality and scope constraints. In the process, all stakeholders, especially project owners and users, may be satisfied. Most importantly, the problem of stalled, failed and unsafe housing projects and the subsequent housing shortages may be solved, albeit to some extent (Hallett, 1993). In addition, project owners may not suffer the losses often associated with collapsing houses and the resultant litigations.

At the individual level, the study may be important in imparting the necessary project implementation skills into project stakeholders. These skills, which are quite vital in the quality delivery of projects, relate to teamwork, project process integration, risk management, reward, compensation and agreements. Managers may also understand the importance of involving end users, contractors and suppliers at the start of the design process and establishing outcome-driven processes and not basing decisions entirely on a first-cost.

The study may also point out to the stakeholders the importance of clear, concise, open, transparent, and trusting communication throughout project life cycle. Importantly, the study may point out the significance of delivering quality and sustainable houses, hence a sustainable built environment. The study may also encourage project teams to base risk and reward on value and to appropriately balance risks and rewards amongst themselves. The study's outcomes may also be useful to the national government and the Nairobi City County government for turning their housing strategies and policy documents into action. From the findings, private project owners and the government may appreciate and implement approaches such as the IPD in small- and large-scale housing projects to build standardized, safe and inhabitable houses for the populace. Consequently, the movement towards realising the Millennium Development goal of eradication of extreme poverty may be set-off. At the national level, the study might help steer the country towards the Vision 2030 social pillar of housing and urbanisation.

By adopting a safety-based approach to project delivery, small-size housing projects may not only be completed within the set timeframe but may also result in lowered construction costs. Moreover, there may be more newly built houses and home improvements; reforms that could help increase housing supply and encourage the development on smaller sites. Finally, these quality houses may help in the diversification of the housing sector by providing the much needed boost to small and medium-sized developers, which have been disproportionately affected in the competitive housing sector.

1.8 Basic Assumptions of the Study

1. The respondents answered the questions truthfully

2. Confidentiality and anonymity was upheld in the study
3. Participation and withdrawal was voluntary and without ramifications.

1.9 Limitations of the Study

The study had several limitations. First, because a sample of convenience was used, the study findings cannot be generalised but may only give inferences to the small-size design-build housing projects in Kasarani Constituency. The other limitation of the study is time. Since the construction and housing sector is dynamic and might change after a period, the study's findings may only be appropriate for the current circumstances as better approaches may be developed later. However, the findings may prove useful for small-size design-build projects for quite a long period. In fact, the elements of IPD studied could be equally important to other types of projects.

Given that the causes of unsafe housing projects in Kasarani Constituency could be quite many, only a few of them have been covered in the study, namely collaborative participation, object-oriented technology, risk-sharing, concurrent project processes and transparency. The others that are just superficially mentioned in the study are trust, project knowledge, values and agreements.

1.10 Delimitation of the Study

This study was delimited by its objectives, research questions and its dependent and independent variables. The other delimitations are the theoretical perspective and the target population of the study. The target population for this study were the consultants, owners, contractors, sub-contractors and material suppliers of small-size design-build housing projects in Kasarani Constituency.

The study was also delimited by the choice of the problem of poor delivery of small-size design-build housing projects in Kasarani Constituency. The sample size was small-size design-build housing projects of ten or less units; each covering gross space of 1,000 M², within the Kasarani Constituency. The projects could be under construction or complete. The study was also delimited by the purpose statement and the intended purpose of establishing the factors influencing the quality delivery of the type of housing project specified in the title of the study.

1.11 Definitions of Significant Terms Used in the Study

Design-build: This is a method of project delivery in which a single entity, known as the design-build team, works in a contract with the project owner to provide design and construction services.

Integrated Project Delivery (IPD): An approach to small-size housing project implementation characterised by collaborative partnership, early involvement, concurrent project processes, transparency, sharing of risks and use of object-oriented or relevant technologies.

Project delivery method: This is the system by which a project team organizes, finances, designs, constructs, operates and maintains a housing project by entering an agreement with other parties.

Quality delivery of design-build projects: The completion of a project of the expected reliability, conformance, durability, serviceability, aesthetics and perceived quality within the set time, speed, safety and cost specification.

Quality delivery: the completion of a project of the expected reliability, conformance, durability, serviceability, aesthetics and perceived quality.

Quality: For purposes of this study, quality refers to the superiority of a small-scale housing project with references to its fitness for purpose, based on the owners' and users' expectations on reliability, timeliness, cost, maintainability and sustainability of a project. Thus, quality is conformance with the cost, time and the satisfactory levels of the project.

Small-size housing projects: For purposes of this study, small-size housing projects are projects whose threshold for developments is 10-units or less on a maximum floor space of no more than 1,000 square metres per unit in Kasarani Constituency, Nairobi County.

1.12 Organization of the Study

The research project is organised into five chapters. Chapter one of the study introduces the topic of the study, gives its background, statement of problem, the study's purpose, objectives of the study, research questions, hypotheses and the significance of the study. Chapter one also contains the basic assumptions, limitations and delimitation of the study. It also contains the definitions of significant terms used in the study and a summary of the organization of the study. Chapter two of the study is the literature review, which consists of an introduction and a review of literatures based on the themes or objectives of the study. This chapter also has the theoretical and conceptual frameworks and an explanation of the relationships among the variables in the conceptual framework and the gaps identified in the reviewed literatures.

Chapter three, the methodology section, outlines the research design, target population, sample size and sampling procedures and the data collection instruments used in the research. It also has the pilot testing, reliability and the validity of the

instruments, data collection procedures and the data analysis techniques used. This chapter also contains the ethical considerations and the operational definition of the variables. Chapter four contains the data analysis, interpretation, and presentation and discussion sections. Chapter five contains findings, discussions, conclusions, recommendations and suggestions for future or further studies. At the end of the study are references and appendices.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviews the studies and other literary materials available on the subject of the study; “The factors influencing the quality delivery of small-size housing projects.” In addition, this section entails the review of literatures on the various themes or objectives of the study. It also contains the theoretical and conceptual frameworks on which the study will be based besides outlining the concept of the paper and the gap identified in the review literature that the study intends to fill. This chapter reviews literatures on the influence of object-oriented technology, collaborative participation, concurrent project processes, transparency and risk-sharing on the quality delivery of design projects.

2.2 Concept of Quality Delivery of Small-Size Design-Build Housing Projects

Design-build project quality is an extensively studied concept. The realization of a quality small-size build-design housing project does not rely on rapid development but on myriad good practice factors such as design, respect, agreements, mutual trust, concurrent processes, collaboration and risk-sharing (Kulkarni et al., 2012). Most importantly, project managers should hit a rapport and achieve a common ground with the clients so that they speak the same language. Second, the project should be designed such that the project manager discusses the structure and the objects in a manner the client understand (Egan, 2002). In addition, the right personnel must be used for the right job if quality is to be achieved. Documentation and communication must be adequate, appropriate and efficient before, during and after project delivery. At the beginning of a project, there should be small iterations

and continuous delivery of parts of a project for review (Kulkarni et al., 2012). Besides coding reviews, it is advised that workers are integrated and swapped, based on their level and type of skills and experiences. It is equally important to stay on top of new and old technology and to use what is best for the project/customer (Richet, 2013). If a newer framework or tool implies more jobs, it could be an inappropriate tool for the job; even though it may be the latest toys

2.3 Object-Oriented Technology and Quality Delivery of Projects

The technology component of project delivery has also been studied. However, little has been studied about the use of technologies such as BIM in Kenya. Hence, most owners and potential project owners are not conversant with the 3D and 4D technologies and their potential to improve project quality.

The American Institute has conducted many case studies on the use of technology in housing projects in the EU and the USA. From the collection of the case studies, it is clear that the idea of object-oriented technology has spread quite fast in the USA because AIA (2012a) did at least a case study in each state then presented these case studies in a matrix form its publication. From this matrix, it is possible for the viewer to navigate through the case studies and compare their strategies. The focus of the case study activities was the way in which project teams applied the elements of project integration including trust, transparency, technology and collaboration. The case studies revealed that lean practices are quite influential in many areas of project delivery (Smith & Tardif, 2009).

Among the targeted projects were big health care buildings, higher education, K-12 education facilities, government or civic buildings, transportation structures, retail buildings (AIA, 2012a). Residential houses represented a rather small portion of

the target projects. What is more, small-size residential houses were not captured in the studied. Clearly, even in the USA, AIA could just identify a few cases of small-size housing projects that use integration-based approaches. Nonetheless, the few that were identified provided enough bases to study the potential of technology to deliver quality housing projects in other cities such as Nairobi.

One of the AIA case studies was the ‘Encircle Health Ambulatory Care Center’ located in Appleton, Wisconsin. The project was a hospital built under a multi-party contract, owned by Encircle Health. The contractor and the architects were Boldt and HGA Architects and Engineers respectively. Boldt provided the main computer model used on the project (AIA, 2012a). However, each subcontractor used its software platform. For instance, the sheet metal contractor in the project used its software to Computer Numerical Control (CNC) fabrication equipment (AIA, 2012a). To detect any clashes among systems, the contractors used a technology called Navisworks (AIA, 2012a). Through the modeling of all the systems, the partners were more assured that every component would eventually fit, implying tighter tolerances.

In essence, the partners avoided hectic and time-consuming shop drawing review processes while the subcontractors only needed to model their work and build on the main model. Because of few coordination errors and the resultant less work, the resources used for building the BIM for the project were more than compensated (AIA, 2012a).

The AIA National and AIA California Council (2007) published an integrated approach guide to educate stakeholders on the principles and influences of collaboration on quality project delivery. The publication, “Integrated Project Delivery Guide,” discusses appropriate technology as a pillar of project quality and success. For an integrated project to succeed, cutting edge technology is a requisite

(AIA National and AIA California Council, 2007). The technology must be specified and identified at the inception of the project for purposes of functionality maximization. Early specification of project technology is also useful for interoperability and generality maximization (Krygiel&Nies, 2008). The preferred technology must be open and interoperable and should be built on transparent and disciplined data structures (AIA National and AIA California Council, 2007). The technologies must also be compliant with local and international industry standards to support communication among stakeholders.

Wilkinson (2005) and Egan (2002) also conducted studies on the use of construction collaboration technologies and their influences on project performance. Through a survey study, Wilkinson (2005) noted that construction collaboration technologies were fast replacing localised sets of data-approaches used in earlier housing projects. In the latter approach, technologies are used to hold data for individual team members or organizations (Egan, 2002).

Collaboration technologies create a centralised repository for data, accessible by all authorised team members (Egan, 2002). In such an accessible data repository, the basic common denominator technology is often used. An example of the technology used in such as system is a computer equipped with an internet browser and an internet telecommunication link (Egan, 2002). The platforms' usability should also reflect the construction industry's extent of using graphical information, especially design drawings. The functionality of the technology should also reflect the need for accessibility, view, mark-up and comment on designs (Egan, 2002).

According to Egan (2002), construction collaboration technologies reflect organization features such as security settings, user administration, and information administration and communication features such as file publication, management and

feedback as well as management features, including management of specific workflows, teams, work packages, multiple projects and standards. Collaboration technologies should also be characterized by sharing, viewing and working with Computer-Aided (CAD)-based drawings (Smith & Tardif, 2009).

2.4 Collaborative Participation and Quality Project Delivery

Quite many studies have been conducted to establish the relationship between collaborative participation and quality project delivery. Some of these studies compare the use of collaborative participation in projects and projects built on non-participative approaches. In 2012, Kulkarni, Rybkowski and Smith conducted a study entitled “Cost Comparison of Collaborative and IPD-Like Project Delivery Methods versus Competitive Non-collaborative Project Delivery Methods.” The purpose of this study by Kulkarni et al (2012) was to establish the contribution of collaborative project approaches to the successful completion of projects and the lowering of project costs. In addition, the study sought to find out the contribution of collaborative project delivery to the attainment of quality projects.

The study focused on the influence of collaborative contract on the extent of collaboration on a project by restricting or permitting specific types and lines of communication, especially in decision-making processes (Kulkarni et al., 2012). The study established that different delivery methods work and rank differently as far as collaboration is concerned. The study’s key purpose thus, was to test whether collaborative project delivery methods impart value on projects. Kulkarni et al. (2012) established the two extremes of project delivery methods as Integrated Project Delivery (IPD) and Design-Bid-Build (DBB). They then compared these methods to ascertain the effects of collaboration on benefits to project owners.

Kulkarni et al (2012) encountered some difficulties in obtaining data on IPD and equally scaled DBB projects. Hence, they settled on data obtained on the closest approaches to IPD and DBB, namely CM-at-Risk (CMR) (developed by the Associated General Contractors of America) and Competitive Sealed Proposal (CSP).

Kulkarni et al (2012) employed a methodology in which they compared the cost performance and reducible change orders of 17 CMR and 13 CSP projects by the same owner. The study's findings indicated that the overall cost performance was more reliable for CMR than for CSP projects while the cost of reducible change orders for errors, omissions and design modifications were lower for CMR than for CSP projects (Kulkarni et al., 2012). The researchers recommended that their study would boost confidence in the benefits of collaborative project delivery methods such as IPD. In addition, it was expected that the study's results would encourage acceptance of integration for quality public projects.

O'Connor (2009) also conducted a study entitled "Integrated Project Delivery: Collaboration through New Contract Forms." According to O'Connor (2009), the current state of the construction industry across the world calls for change. His study sought to establish the reason stakeholders should collaborate and share risks associated with collaboration. O'Connor (2009) identified the key to successful implementation of IPD as people, processes and promises. Respectively, O'Connor (2009) recommends that for people, the right team should be selected, for effective processes; people should be managed well while for promises, project team should be motivated. O'Connor's (2009) other objective was to establish whether IPD agreements are new types of contracts or not and to identify the prerequisites for successful collaborative undertakings.

In his study, O'Connor (2009) analyzed various government documents, reports and contract forms as well as documents from the American Institute of Architect (AIA). As a counsel to the AIA's Document's Committee Task Group responsible for drafting the C195 standard forms for IPD, he was given the task to conduct a research on the creation of IPD collaboration forms for project procurement and implementation. After conducting his critical literature review and analysis of government and AIA forms and documents, O'Connor established that the IPD has huge potential for improving productivity gains in design and construction services.

In agreement with this study, O'Connor found out that quite few projects are using an integrated model. Hence, O'Connor (2009) concurred that there is little empirical information to support the performance of the integration-based methods. In spite of the scarce empirical data, there is no doubt that collaborative participation can result in more quality accomplishments compared to non-collaborative models. Therefore, there is need and space to change or improve on the traditional approach to project delivery. O'Connor (2009) established that in the United States of America, the AIA and the 'ConsensusDOCS' spearheaded the movement towards the use of contract forms for project partners interested in the adoption of more collaborative project delivery models.

Such organizations and contract forms for more collaborative project delivery are missing for the case of Kasarani Constituency. Therefore, this study would be appropriate in highlighting the importance of collaboration and integration, in the process, showing evidence organizations or agencies with the mandate to avail such forms or contracts should be established. In other terms, whereas there are project practitioners and owners who use IPD and other more collaborative models of project

delivery, there are no agencies and professional organizations to offer related legal and other professional services.

Also to study collaborative and integrated approaches to project delivery were Raisbeck, Ramsay and Maher (2010) in a study entitled “Assessing Integrated Project Delivery: A comparative Analysis of IPD and Alliance Contracting Procurement Routes.” Like most other studies of its ilk, this study’s purpose was to give evidence on the purported high potential of IPD to achieve superior project results compared to other procurement and delivery methods. Specifically, Raisbeck et al (2010) compared the IPD and alliance contracting models. The researchers sought to establish whether collaboration and behavioral change are key values in IPD.

Raisbeck et al (2010) established that digital technology (such as IBM) is the other key element of project integration. Hence, the integration of technology in contracts must be accompanied by collaborative engagement among partners. Raisbeck et al (2010) observed that although alliance contracting and integration models resemble in the key role of collaboration; there are some difference between the models. First, IPD has a tool for collaboration, physical maps, which partners use to discuss project schedules and sequence of processes as an integrated team (Egan, 2002; Raisbeck, 2010). This feature of integration of project processes and participants is referred to as the ‘big room’ environment.

2.5 Concurrent Project Processes and Quality Project Delivery

The other key component likely to influences the quality delivery of projects is concurrent project processes. It is in this context that the safety of small-size housing development in Kasarani Constituency suffers most. In spite of the apparent lack of literature and knowledge on the integration of concurrent processes in project

Implementation, at the local level, some contractors and owners have adopted the integration of concurrent engineering processes in project delivery. At the global level and in the larger construction industry, many partners, especially project engineers have embraced the integration of processes to improve project delivery(Egan, 2002). Similarly, literatures abound on the subject of concurrent processes and its influences of the quality of projects.

Malik (2002) of Salford Centre for Research and Innovation (SCRI) conducted a study entitled “Improving Construction Process through Integration and Concurrent Engineering.” The purpose of this study was to discuss the adoption of integrated processes and Concurrent Engineering (CE) in the construction industry and the ways in which construction organizations can use CE and integrated processes to improve project delivery. (Raisbeck, 2010) defines concurrent engineering as a systematic approach to engineering that focuses on an integrated and concurrent designing of project processes (manufacture and support) and products. According to the approach, project partners must take into account all elements of quality, schedule, cost and user requirements of project life cycle (conception to disposal) (Malik, 2002).

Malik (2002) compared the traditional approach and the CE approach to project processes. Notably, the traditional approach was portrayed to have a number of disadvantages. These weaknesses of the traditional approach include fragmented participation, fragment design and construction data, costly design changes, uncalled for liability claims, absence of life-cycle analysis and ineffective communication to other parties on project rationale (Raisbeck, 2010; Malik, 2002). Because of the weaknesses associated with the traditional approach to project processes, Malik (2002) recommended a shift in paradigm in the construction industry. In this paradigm shift, stakeholders such as architects, quantity surveyors, structural,

mechanical and electrical engineers, main contractors and materials suppliers should all be involved in the design project (Malik, 2002).

These stakeholders should then apply CE principles and practices throughout the project life cycle. The elements of CE proposed included the identification of all the aspects of design and construction processes and the bringing together of specialists and subcontractors early in the design phase. In addition, CE should be characterized by a multi-disciplinary team working in a collaborative manner to reduce or eliminate activities and processes that do not add value. Malik (2002) proposed the following team structure as supportive of concurrent engineering and processing in project implementation.

Janez, Rihar, Berlec and Starbek (2010), in a publication, noted that project-driven and concurrent process and product development are integral to quality project delivery. Junez et al (2010) noted that the international construction market demands shorter product development time and low costs. Hence, construction firms should shift from sequential to concurrent project processes and products. A prerequisite for this transition are teamwork and strategic management characterized by integration, standardization and parallel activities (Junez et al., 2010). Thus, Junez et al (2010) proposed efficiency in teamwork and integration of strategic management into process and product development. The study was conducted through an analysis of team-work capability, motivation, susceptibility to dysfunctions and personal value systems in construction companies.

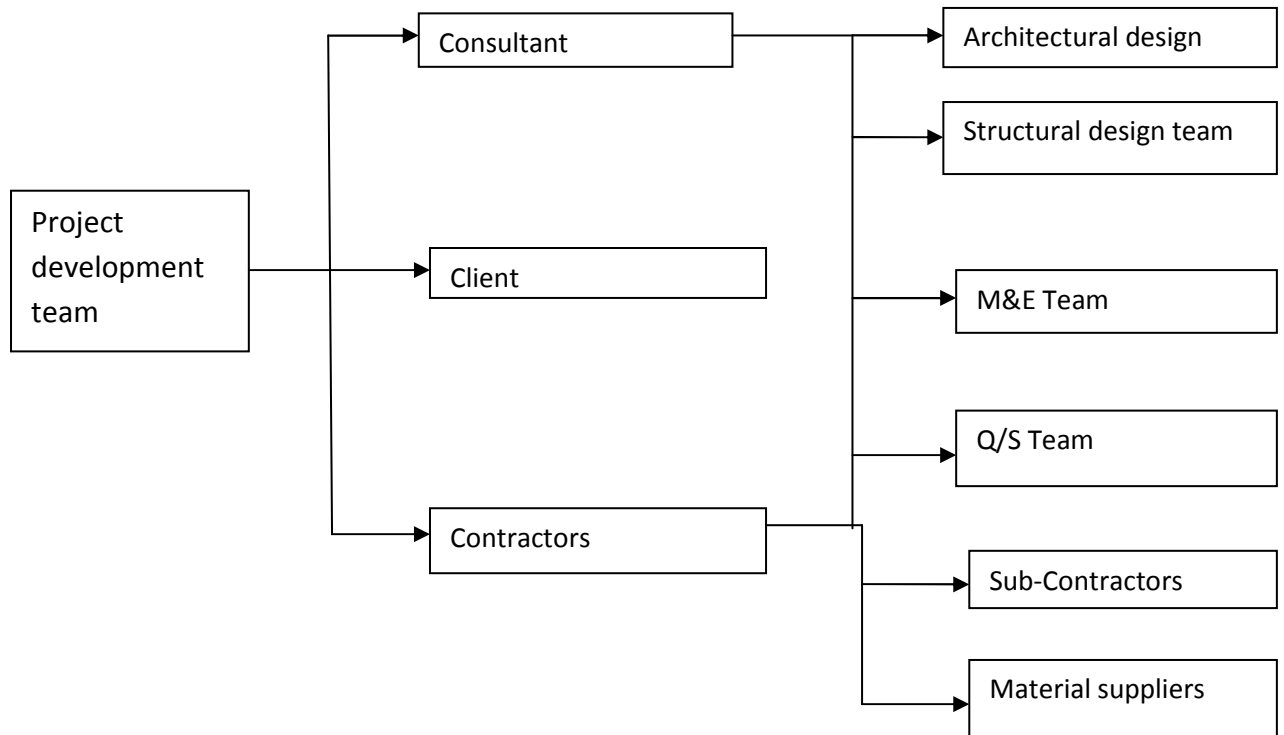


Figure 2.1: The main stakeholders in ensuring concurrent project processes

An integrated and concurrent project processes and environment has the potential to grow and develop the construction industry and make it more competitive climate for business (Barbara, 2010). Malik (2002) also proposed the integration of technologies such as virtual reality, intelligent agents, video conferencing and multi-media to support project integration and concurrent processes. The integration of these IT systems would not only improve project coordination but also visualization and supply chain management (Barbara, 2010). Consequently, construction projects would report increased project performance, profitability, quality, stakeholder involvement, and client satisfaction and reduced cost and construction time.

2.6 Transparency and Quality Delivery of Projects

A study that focused on project processes and transparency was conducted by Klotz (2011) under the title “Process Transparency for Sustainable Building

Delivery.” The researcher used the method of counterfactual analysis to establish whether increased process transparency in sustainable housing projects could result in reduced cost. An advantage of the counterfactual analysis method used on this study is that it is quite comprehensive and straightforward (Klotz, 2011).

Counterfactual analysis also relies on local available resources (Raisbeck, 2010; Klotz, 2011). Klotz (2011) used the counterfactual analysis method to assess the delivery of the complete School of Architecture and Landscape Architecture (SALA) and Forest Resources buildings on Penn State’s University Park campus. Based on the application of this method in the study of these buildings, Klotz (2011) asserts that counterfactual analysis is quite ideal for developing theories on project delivery.

In his counterfactual analysis, Klotz (2011) discovered that projects with multiple partner organizations are prone to encounter imperfect process transparency. In fact, imperfect process transparency is also common in single organization projects. Process transparency is quite important at the project-level for project partners or groups engaged in unfamiliar processes (Koltz, 2011).

Anumba and Nosa (1997) studied the influence of the concept of concurrent processes on the quality delivery of projects. In a study entitled “Concurrent Engineering in Design-Build Projects” and published in the 3rd Issue of Volume 15 of the Construction Management and Economics Journal, Anumba and Nosa (1997) noted the significant changes that design and build procurement method had undergone in the UK construction sector in the preceding decade. In particular, Anumba and Nosa (1997) noted that design-build approach was used in both private and public projects of different sizes and complexities. They noted the advantages of build-design procurement as short lead times, contractor involvement in design

processes, greater cost certainty, more effective communication and shorter construction time (Raisbeck, 2010).

Anumba and Nosa (1997) noted a few weaknesses of the design-build method. The noted disadvantages included reduced design quality, restriction of changes by the client and high costs of tendering. Because of these weaknesses, Anumba and Nosa (1997) proposed a new procurement route with fewer shortcomings. This proposed model would promote concurrent project design and implementation by integrating all participants in a multi-pronged and multi-functional team matrix (Raisbeck, 2010). This team matrix would enable the resolution of all likely downstream challenges at the early phases of a project life cycle. Through a design function deployment that is an engineering design system that supports concurrent processes, projects would be provided with a formal mechanism for improving abstractions of client requirements (Barbara, 2010).

From the weaknesses of design-build projects identified by Anumba and Nosa (1997), it is clear that the integrated project delivery approach comes in handy in addressing some of these weaknesses. Considering that most small-size housing projects are built under design-build arrangements, which are prone to reduced design quality, an integrated approach would be appropriate for the successful implementation of such projects. Anumba and Nosa (1997) therefore provide substantial support for this study, which seeks to establish and advise stakeholders of the influences of concurrent processes on the quality delivery of small-size design-build housing projects in Kasarani Constituency.

2.7 Risk-Sharing and Quality Delivery of Housing Projects

Risk-sharing is the other factor believed to influence the quality of design-build projects, especially housing developments. AIA targeted one of the IPD-projects in the USA to establish the influence of risk/reward sharing on quality project delivery. AIA studied the Cathedral Hospital project in San Francisco, California. The project was under a single multi-party contract-Integrated Form of Agreement (IFOA). The owner of this project was California Pacific Medical Center, an affiliate of Sutter Health. In this project, AIA analyzed the IFOA contract forms and established that the form had a provision for a risk-pool to which parties, especially the architect, main design consultants and primary trade contractors were bound (AIA, 2012b).

In this case study, the project team was required to participate in this risk-pool by putting a certain percentage of their profits to partially offset any risks associated with project cost overruns and other liabilities that might have been incurred. The risk-pool also provided for incentives in form of payments in case the project team achieved actual project costs or incurred lower costs (AIA, 2012b).

In the risk-pool, the architect put 25% of its preconstruction and construction fees profits at risk (AIA, 2012b). The other members of the team in the risk-pool for this project were the architect's consultants, the structural engineers (Degenkolb Engineers), electrical engineers (Silverman and Light Inc.) and Ted Jacob Engineering Group Inc. Also in the risk-pool were the project's trade contractors; Rosendin Electric (electrical), Charles Pankow Builders Limited (concrete) and Southland Industries (mechanical) (AIA, 2012b).

2.8 Theoretical Framework

This study is based on the theory of Agile Project Management, developed in 1998 by Harvard Business School academics Robert Austin and Richard Nolan and a respected IBM researcher named Watts Humphrey. Theory of agile project management postulates that stakeholder collaboration, which enhances interoperability of project processes and information among project owners, constructors and subcontractors and workers, is key to quality project delivery. The theory of agile project management also emphasizes the need for project owners to handle the setting of project goals, the trade-off of schedule, relative to the scope, adapt to changing project requirements and to set priorities for project requirements and features (Koskela, 2010). On the other hand, the project manager is expected to work with and guide the entire team in task prioritization and reduction of risks and other impediments to project implementation (Koskela, 2010). The theory also expects that project teams directly involve in the tasks assignment. The other postulates of the theory are that project quality depends on daily detail management, progress reporting and quality control for the project under implementation.

The agile theory is relevant to this study since its project management principles seek to improve efficiencies and support the reduction of cost and quality improvement through the collaborative resolution of issues at the earlier stages of a project (Richet, 2013). The theory also supports the harnessing of the associated benefits of integration in projects, compared to the traditional project design and implementation approach (Richet, 2013). In addition, the effectiveness of integration and collaborative participation on the quality project delivery can be ascertained by analyzing and comparing the planned project programmes with the actual programmes. Like agile project management, this study seeks to prove and

recommend a collaborative design process, to which will be attributed fewer process iterations and the subsequent comprehensive conceptual design at an early stage (Richet, 2013). Also, in agile project management, more information and documentation is produced and made available to partners. In addition, overall project goals are often exceeded with project indicating improved time, cost and design quality control (Richet, 2013).

Agile project delivery has numerous advantages and relevance to this study. For instance, the theory confers more collaborative and intense perceptions on projects stakeholders, especially in the design phase of a project. With competition increasing in construction and the increasing use of and changes in technology, construction stakeholders are on the lookout for more effective project delivery methods. Moreover, the emergence of bigger and more complex housing projects has created a competitive environment for contractors and consultants as project owners only look for the best contractors, consultants and engineers (AIA, 2007). Agile project management theory is portrayed as a project delivery approach, which emphasizes the integration of project stakeholders, project systems, processes, structures and practices (AIA, 2007). Through team work, agile project management harnesses all the talents, resources, insights, capacities and expertise of project partners to optimize project outcomes.

2.9 Conceptual Framework

The conceptual framework organizes and distinguishes the ideas of the project, especially the variables and their connections to the purpose and objectives of the study

Independent Variables

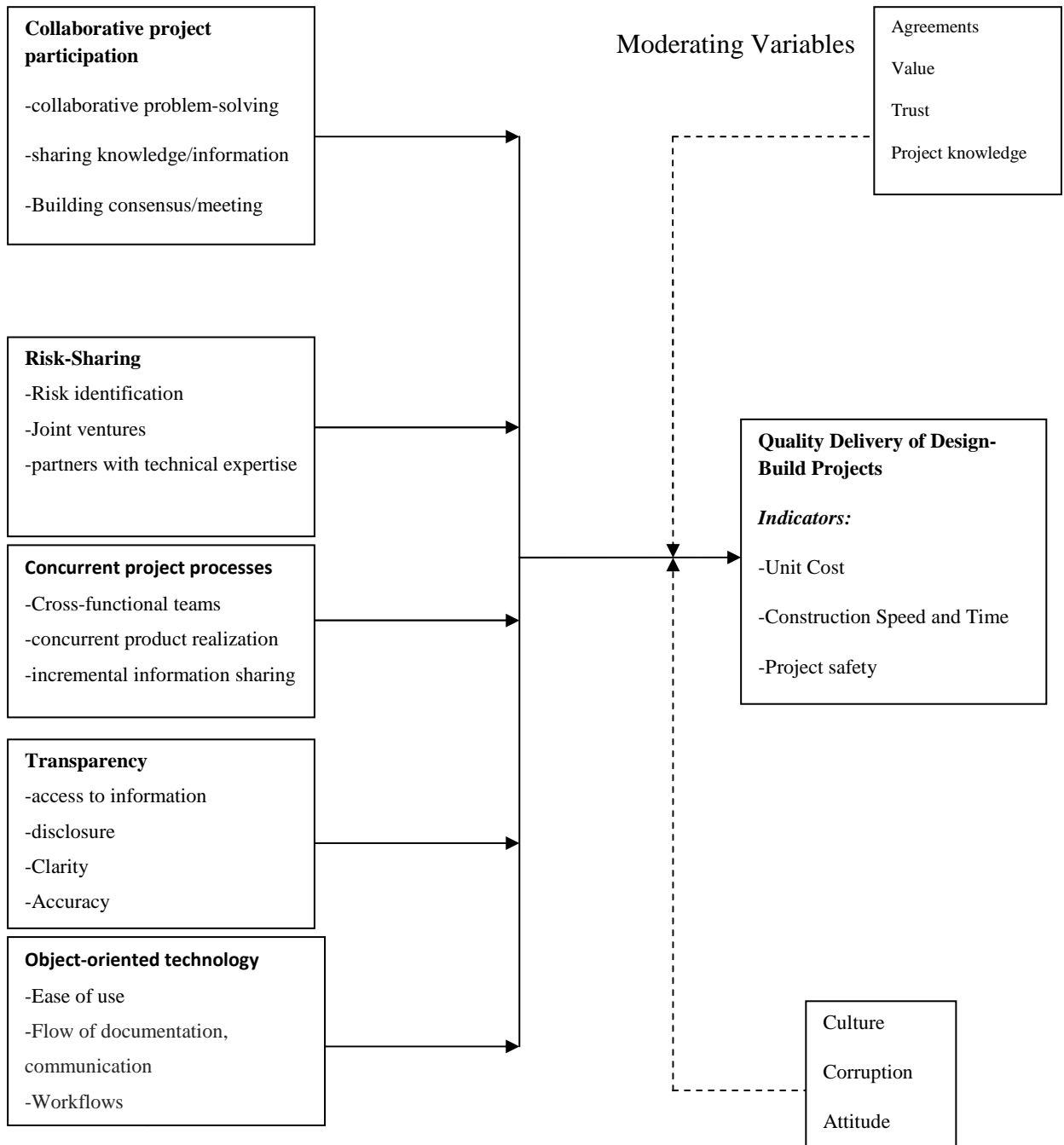


Figure 2.2: The conceptual framework

It is perceived that the independent variables of collaborative participation, risk-sharing, object-oriented technology, concurrent project processes and transparency influence the dependent variable, quality delivery of design-build projects. Some of the variables that moderate or influence the strength and direction of this relationship are project knowledge, trust, value and agreements.

2.10 Knowledge Gap

At the local scene, literature on factors of quality project delivery lacks. If any, quite few studies conducted on housing project delivery in Kenya and Nairobi in particular generally tackle the challenges and factors of safety of housing projects and the right interventions. Owoko (2013) conducted a study entitled “Determinants of Successful Delivery of Housing Construction Projects in the Ministry of Housing in Nairobi, Kenya.” The main aim of this study, and others of its ilk, was to identify the main success factors of housing project in Nairobi. However, the available literatures on the local scene do not emphasize the need for a shift in the approaches of project delivery from the traditional to integration- and collaboration-based approaches. In fact, most literature cover the delivery parameters of time and cost, largely ignoring quality and the importance of the factors such as collaboration, integration of digital technologies such as BIM, trust and transparency, concurrent processes and risk-sharing on quality and safety.

2.11 Summary of Literature Review

Like Owoko (2013), many of the local literatures simply identify, rank and analyze the factors of project success without giving alternative approaches or methods through which these parameters can be adjusted to improve product quality.

It is not enough to just identify and rank these factors; more ought to be done to suggest a wholesome shift in the approach used to incept, plan, implement and operate housing projects. In addition, studies by local students and scholars seem to focus more on large scale housing projects by agencies such as the Ministry of Housing (Civil Servant Housing Schemes) and the National Housing Corporation (NHC). That is, the equally important small-size houses, which also form part of the drive towards Vision 2030 is largely ignored.

Evidently, the findings of this study will hugely contribute to a complete shift in the project implementation and delivery approach to small-size design-build housing projects in Nairobi City County. In addition, the study and its findings will be useful to other sectors of the construction industry and government policy makers and the larger project management discipline. The study may also be expanded to cover larger samples for the country, the East African and the African region to shift from the traditional approach to the IPD approach to project delivery. By the expansion of this study into a wider sample, stakeholders will not only be knowledgeable about IPD but will also access more literature on IPD project delivery, thereby contributing to the general development of the region.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter outlines the procedures and activities that the research followed to achieve its objectives and purpose. Thus, described in this section are the research design, target population, sample size and sampling techniques, research instrument's piloting, reliability and validity, data collection and analysis procedures and techniques, ethical considerations and operationalization of variables.

3.2 Research Design

A descriptive cross-sectional survey design was used to investigate the relationship between the independent variables and the dependent variable of quality delivery of small-size design-build housing projects in Kasarani Constituency. The study's setting is the Kasarani Constituency of Nairobi County. The participants were the stakeholders in the small-size design-build projects, namely project owners, contractors, subcontractors, engineers, suppliers and project workers. The primary outcome is a report on the status of the safety of the target housing projects in Kasarani Constituency for at least the last one year. Data on the independent and dependent variables was obtained by questionnaires of structured and unstructured items.

The independent variables investigated included collaborative participation, concurrent project processes, risk-sharing, object-oriented technology and transparency. Being a descriptive study, the cross-sectional design entailed the measuring of the different variables in the population of interest at a single point in time, giving a snapshot of conditions present at that instant. Its advantages are ease of

data gathering and low to moderate cost while its main weakness is that it does not establish the causality amongst the variables. Hence the design was appropriate for establishing the relationship between the independent and dependent variables.

3.3 Target Population

The study targeted key stakeholders in the small-size housing developments sector within Kasarani Constituency, especially in the estates where most small-size housing projects are found. The target population, obtained from Nairobi City County databases, was 70 keystakeholders directly involved in small-size housing projects in Kasarani, namely owners (clients), project managers, contractors, constructors, sub-contractors, engineers and consultants. The target projects were 30 housing projects with ten or fewer units, each covering a gross area of 1000m².

3.4 Sample Size and Sampling Procedures

The study was based on as big a sample as possible to help achieve high degree of similarity between the findings of the study and the population.

3, 4.1 Sample Size

Based on the target population of 70 and 95% confidence level, the study's target sample was 60 small-size housing project stakeholders in Kasarani Constituency. In the sample, 30 were project owners while the other 30 were projects workers. The sample size was determined using Krejcie and Morgan Table for Sample Size Determination.

3.4.2 Sampling Procedure

The sampling procedure for the study was probability sampling, which offered each member of the sample an equal chance of selection from the target population. Probability sampling was ideal for the study since the targeted small-size design-build housing projects in Kasarani Constituency is too large a group to be studied as an entity. Through random probabilistic sampling, it was possible to capture the heterogeneity in the target population and the subsequent generalization of the findings to a larger population. Simple random sampling was used to pick the projects identified as small-size design-build housing projects.

To achieve representation of all the subgroups identified in the target population, stratified random sampling technique was used to obtain 30 project owners and 30 members of project teams. The latter group consisted of contractors, subcontractors, suppliers, engineers and project workers involved in small-size design-build housing projects.

3.5 Research Instruments

The study used two questionnaires to collect data and information from the target subgroups identified earlier. In the questionnaires, each item developed addressed a specific objective and research question in relation to the study purpose and hypothesis. The questionnaires were clear to the respondents on the nature of information required and were designed to encourage respondents to fill it; simple and clear. All the information required for the study was captured in the questionnaires. The items in the questionnaire were structured/closed and unstructured or open-ended. There were also matrix questions for ease of completion.

3.5.1 Pilot Testing of the Instruments

Once developed, the questionnaires were tested in the field using a sample with features similar to the actual target sample, using the exact procedures used in the study. However, the subjects used in the pre-test were not used in the actual study. A pretest sample of 10 respondents was used. In the pretest, the respondents had a chance to comment on the questionnaire's clarity and relevance. Vague questions that would have attracted grossly different interpretations and answers were then rephrased. Unclear direction, lack of writing space, untidiness and poor numbering are the other issues that were identified during pre-testing and corrected. The Likert, nominal and ordinal scales were used in the questionnaire.

3.5.2 Validity of the Instrument

The study strived to uphold the meaningfulness and accuracy (the validity) of the instrument. The types of validity ensured included construct validity, content validity, criterion validity and internal and external validity. To attain internal validity, the external strenuous factors of the study were tightly controlled. That is, it was ascertained that the changes in the dependent variable would be actually caused by the independent variable and not other variables not covered by the study. For external validity, the sample had to be representative of the target population, allowing the accurate generalization of the findings to small-size housing developments in the Constituency. The study strived to yield results that would be obtained elsewhere and at different times, if the setting remains the same and other key factors are kept constants.

3.5.3 Reliability of the Instrument

For purposes of reliability, the study endeavored to ensure the findings would be consistent, if the study were to be repeated. Random errors were avoided at all stages of the study to eliminate deviations from the true findings. Coding was accurate while the questionnaire instructions were drafted as unambiguously as possible. To achieve reliability, respondent fatigue, interviewer fatigue and bias were avoided in the administration of the questionnaires. In addition, random errors caused by instrument inaccuracy, scoring inaccuracies and unexplained errors were eliminated using the split-half reliability method.

In this method, 15 respondents were given the questionnaire to fill all the items. The total score was then computed for each respondent and entered in an Excel spread sheet. The filled questionnaires were then split into odd and even-numbered scores for each respondent, covering all the constructs or variables of the study. The scores for odd and even number items were then computed for each participant as shown in the Excel spreadsheet. The correlation coefficient and the Spearman-Brown coefficient were then calculated to be 0.667277 and 0.800439 respectively, indicating the instrument's high reliability (Mugenda & Mugenda, 2012).

Respondent	Total Score	Even	Odd	
1	42	22	20	Correlation coefficient=0.667277
2	33	18	15	Spearman-Brown correction=0.8800439
3	44	23	21	
4	45	21	22	
5	30	15	16	
6	26	14	11	
7	45	21	24	
8	35	17	18	
9	40	17	23	
10	32	16	16	
11	34	19	15	
12	45	23	22	
13	37	17	20	
14	34	16	18	
15	30	14	16	

3.6 Data Collection Procedures

Prior to the actual collection of data from the participants, the proposal was presented to the supervisor for approval and defense. Upon approval of the proposal, letter of introduction from the university was obtained as well as a permit from the National Commission for Science, Technology and Innovation (NACOSTI) for the research to be conducted. The two research assistants were then trained and briefed on their work after which appointments were booked with the participants, identified from Nairobi City County database of completed and almost complete housing projects for the half-split test and later, the actual study.

The questionnaires were administered through self-administration and researcher administration, depending on each respondent's circumstances and

preferences. In self-administration, the questionnaire was hand-delivered to the respondents. In research-administration, the researcher assisted the respondents in cases of interpretation or reading challenges.

3.7 Data Analysis Techniques

To gather useful data and information from the study, the gathered data was inspected, cleaned, transformed and modeled to a form from which conclusions and supportive-decision making can be attained. The data was analysed to test the hypotheses of the study. First, the collected data was organized for faster and more accurate analysis using tables, spreadsheets and statistical software, Statistical Package for Social Sciences (SPSS). The data was then cleaned to remove duplicates and errors by de-duplication, record matching and column segmentation.

For data analysis purposes, the study was interested in describing the association among the variables and the right intervention. For description, frequencies were used while for correlation and intervention, Spearman's rho was used. Nonparametric correlation tests helped determine the relationship between the independent and dependent variables.

3.8 Ethical Considerations

The study put into consideration a number of ethical issues, especially because of the fact that the researcher had to interact with the respondents through the questions in the questionnaire to get their opinion on the subject of the study. First, the researcher avoided plagiarism and has not presented another author's work as his. Any ideas borrowed from other authors and researchers have been duly acknowledged. The researcher has also not faked data but has obtained genuine data

from the respondents. Second, the researcher did not misuse the privileges and powers associated with his level of training, experience and legal authority to undertake the study. The researcher did not abuse the trust, which formed the basis of cooperation from participants. The privacy and the confidentiality of the respondents were also observed and their consent obtained and voluntary participation assured to prevent any physical or psychological harm to the respondents. Anonymity was also upheld by not revealing the respondents' identity.

The research was also done in a way that did not predispose the participants to physical or psychological harm. The findings of the study have also been disseminated, whether they conform to or contradict the expectations. This research has also not ignored the pertinent issues that came up, regardless of the controversies they might create, thus upholding academic freedom. Equally important was the obtainment of approval letter from the relevant government agency to conduct the study. The study was only conducted once the necessary approval letters were obtained from the University of Nairobi and the National Commission on Science, Technology and Innovation (NACOSTI).

3.9 Operational Definition of the Variables

This section explains the dependent and the independent variables to be investigated in the study in relation to the objectives of the study.

Table 3.2: the operational definition of the variables

Objective	Variable	Indicator	Measurement	Scale	Data Source	Instrument	Data Analysis
Quality delivery of small-size housing projects	<u>Dependent variable</u>	Unit Cost	Expenditures (KSH)	Ordinal	Project budget, project owners	Questionnaires, document analysis	Spearman's Rho, descriptive statistics
		Construction speed and time	Construction duration	Ordinal	Project team, Timeframe/Plan	Questionnaires and document analysis	Spearman's Rho, descriptive statistics
		Product safety	Number and frequency of Product defects	Ordinal	Contractors, subcontractors, suppliers	questionnaires	Spearman's Rho, descriptive statistics
	<u>Independent Variables</u>						
Objective 1: To establish the	Object-oriented technology	Ease of use	Frequency of use	Nominal	Project team	Questionnaire	Spearman's Rho, descriptive statistics

influences of object-oriented technology on the quality delivery of small-size Design-Build housing projects in Kasarani Constituency, Nairobi		Flow of documentation or communication	Existence of documents, letters, notices	Ordinal, Likert	Documents, project team	Questionnaire	Spearman's Rho, descriptive statistics
		Ease of workflows	Work schedule and completion	Nominal	Documents, project team	Questionnaire	Spearman's Rho, descriptive statistics
Objective 2: To establish the influences of collaborative participation on	Collaborative participation	Collaborative problem-solving	Meetings	Likert, ordinal	Documents, project team	Questionnaire	Spearman's Rho, descriptive statistics
		Sharing knowledge/information	Meetings, notices, letters	Nominal, ordinal	Documents, project team	Questionnaire	Spearman's Rho, descriptive statistics

the quality delivery of small-size Design-Build housing projects in Kasarani Constituency		Building consensus or meetings	Minutes, notices, documents	Nominal and ordinal	Documents, project team	Questionnaire	Spearman's Rho, descriptive statistics
Objective 3: To establish the influences of concurrent project processes on the quality delivery of small-size	Concurrent project processes	Presence of cross-functional teams	Teams, task allocation, breakdown	Likert and ordinal	Work plan, project team	Questionnaire	Spearman's Rho, descriptive statistics
		concurrent product realization	Presence of multidisciplinary teams, sharing data	Nominal, Likert	Project team, documents	Questionnaire	Spearman's Rho, descriptive statistics
		incremental information sharing	Notices, meetings	Nominal	Documents, project team	Questionnaire	Spearman's Rho, descriptive statistics

Design-Build housing projects in Kasarani Constituency							
Objective 4: To establish the influence of transparency on the quality delivery of small-size Design-Build housing projects in Kasarani Constituency	Transparency	Access to information	Notice boards, meetings	Nominal and ordinal	Documents, project team	Questionnaire	Spearman's Rho, descriptive statistics
		Clarity	Medium, message specificity	Nominal	Documents, project team	Questionnaire	Spearman's Rho, descriptive statistics
		Accuracy	Communication plan, guideline, responsibilities	Nominal	Documents, project team	Questionnaire and documents	Spearman's Rho, descriptive statistics

Objective 5: To establish the influence of risk-sharing on the quality delivery of small-size design-build housing projects in Kasarani Constituency	Risk-sharing	Risk identification	List of hazards and risk events	Nominal	Documents, project teams	Questionnaire and documents	Spearman's Rho, descriptive statistics
		Joint ventures	Agreements, pooling of resources	Ordinal	Documents, project team	questionnaire	Spearman's Rho, descriptive statistics
		partners with technical expertise	Risk experts	Nominal and ordinal	Project team	questionnaire	Spearman's Rho, descriptive statistics

Table 3.1: Operational definitions of the variables

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION, INTERPRETATION

4.1 Introduction

This chapter contains the data analysis, presentation, and results interpretation sections of the study. It explains how the data was organized, analyzed, interpreted and presented. It also explains the meaning and implications of the findings of the study.

4.2 Questionnaire Return Rate

The study's sample size was 60 small-size housing project stakeholders in Kasarani Constituency, to whom questionnaires were delivered. Of the thirty project owners targeted, 25 returned their completed questionnaire while 29 of the 30 project team members targeted returned completed questionnaires. Overall, the questionnaire return rate was 90%, which is an acceptable return rate (Mugenda & Mugenda, 2012).

4.3 Characteristics of the Respondents

The respondents in the study were small-size housing stakeholders, namely project owners, contractors, subcontractors, constructors, suppliers and engineers working in projects within Kasarani Constituency.

4.4 Presentation and Interpretation of the Findings on the Variables

This section contains the findings on the independent variables and their influences on and relationship to the dependent variable of the study

4.4.1 Object-Oriented Technology and Quality Delivery of Design-Build Projects

The use of technology is believed to have a huge impact on the quality of housing projects. In particular, the use of object-oriented technologies goes a long way to create safe and inhabitable houses. Rather than use basic technologies merely to save cost, project owners and managers ought to use the latest and the best technology that would create quality projects.

Table 4.1

Distribution for Technology Ease of Use

	Frequency	Percent	Cumulative Percent
Yes	25	86.2	86.2
No	4	13.8	100.0
Total	29	100.0	

Table 4.1 shows that 86.2% of project team respondents reported that the technologies applied in their projects was easy to use. Project owners resort to the cheapest technologies to help reduce cost, at the expense of quality. Notably, the technologies in use are basic and relate to cement, sand, concrete, metal bars and stone, explaining the ease of use. That is, not a single respondent mentioned modern technologies such as Building Information Modelling (BIM), Computer-Assisted Design (CAD), 4D or 3D technologies. Only 13.8% felt the technologies are not easy to use.

Table 4.2*Distribution for “Technology Increases Project Speed” for Project Teams*

	Frequency	Percent	Cumulative Percent
to a great extent	15	51.7	51.7
moderate extent	13	44.8	96.6
does not increase speed	1	3.4	100.0
Total	29	100.0	

Table 4.2 shows that 51.7% of project team respondents felt that technology increases project speed to a great extent while 43.3% said the increase in project speed because of technology use was only to a moderate extent. Overall, 96.6% agreed that technology increases project speed, even if to different extents. Thus, object-oriented technology increases the quality delivery of small-size design-build projects to the extent that the said technology is easy to use, thus increasing speed and saving time. However, technology that is expensive and requires workers to be trained increases project cost, thus duration.

Table 4.3*Distribution for ‘Technology Promotes Concurrent Project Processes’ for Project Teams*

	Frequency	Percent	Cumulative Percent
Yes	25	86.2	86.2
No	4	13.8	100.0
Total	29	100.0	

Table 4.3 shows that 86.2% of the project team participants reported that technology promotes concurrent project activities while 13.8% felt technology does not promote concurrency in project processes.

Table 4.4

Distribution for Technology Promotes Project Concurrent Processes'

	Frequency	Percent	Cumulative Percent
Yes	15	60.0	60.0
No	10	40.0	100.0
Total	25	100.0	

Table 4.4 indicates that 60% of the project owner respondents felt that the use of technology in construction projects results in concurrent project processes. The differences in the owner and project team scores could be attributed to the fact that project workers such as engineers, contractors, constructors and subcontractors are closer to the technologies hence, they understand their use and effects on projects than project owners do.

Thus, object-oriented technology influences the quality delivery of small-size design projects to the extent that it reduces defects, delays and re-works, through promotion of concurrent processes and concurrent realization of project milestones or products. Object-oriented technology thus promotes design-build projects safety by improving safety through elimination of defects.

Table 4.5*Distribution for 'Technology Use Influences Project Safety' by Project Owners*

	Frequency	Percent	Cumulative Percent
to a great extent	7	28.0	28.0
to a moderate extent	12	48.0	76.0
does not influence	5	20.0	96.0
Missing	1	4.0	100.0
Total	25	100.0	

Table 4.5 shows that 76% of the project owners felt that technology use influences project safety, 21.9% stated 'to a great extent' while 37.5% settled for 'to a moderate extent'. Only 15.6% felt that technology use has not effect on project safety. Thus, technology influences the quality of small-size design-build projects to the extent to which it ensures the health and safety of workers and project.

Table 4.6*Distribution for 'Technology Use Influences Project Unit Cost' by Project Owners*

	Frequency	Valid Percent	Cumulative Percent
to a great extent	12	48.0	48.0
moderate extent	12	48.0	96.0
Does not influence	1	4.0	100.0
Total	25	100.0	

Table 4.6 shows 96% of the project owner respondents indicating that technology use influences project unit cost. Hence, most project owners opt for simple stone, cement, concrete and metal bar technologies, ignoring advanced technologies that might increase

costs. Thus, object-oriented technology promotes the quality delivery of small-size design-build projects to the extent that it does not increase the project cost to unsustainable levels. Otherwise, expensive technology jeopardizes the quality delivery of small-size design project by escalating the cost, even to levels beyond the reach of project owners.

Table 4.7

CROSSTAB For Technology Ease Of Use by Satisfaction with Project Safety by Project Teams

Satisfaction		with				Total
Project Safety		Extremely satisfied	Satisfied	Neutral	Dissatisfied	
Ease of technology Use:	Yes	3	15	1	6	25
	No	2	1	0	1	4
Total		5	16	1	7	29

From table4.7, it is noted that 3 and 15 of the project team participants that responded that the technologies in their projects were easy to use were also ‘extremely satisfied’ and ‘satisfied’ with the safety of the project, respectively. Only six of those who responded ‘yes’ to ‘ease of technology use’ were dissatisfied with the safety of their projects.

Table 4.8*Spearman's Rho for Technology Ease of Use and Satisfaction with Project Cost*

			Satisfaction with project cost	Ease of technology use
Spearman's rho	Satisfaction with project cost	Correlation Coefficient	1.000	.393*
		Sig. (1-tailed)	.	.025
		N	29	29
	Technology ease of use	Correlation Coefficient	.393*	1.000
		Sig. (1-tailed)	.025	.
		N	29	29

*. Correlation is significant at the 0.05 level (1-tailed).

Table 4.8 indicates significant positive relationship (Spearman's rho value of 0.393) between the level of satisfaction with project cost and the quality delivery of small-size design-build housing projects, through the ease of technology use. At the 0.05 level, using a one-tailed test, the calculated value of +0.393 is greater than the critical value at +0.3115, so the hypothesis;

H₁₁ There is significant relationship between object-oriented technology and the quality delivery of small-size design-build housing projects in Kasarani Constituency is not rejected.

4.4.2 Collaborative Participation and Quality Delivery of Design-Build Projects

Regardless of how prepared and equipped a project team is, quality projects are bound to remain elusive without collaborative participation among project team members. Working in isolation is likely result in uncoordinated and substandard housing projects.

Table 4.9

Distribution for 'Teamwork In A Project Reduces Time Wastage' for Project Team

	Frequency	Valid Percent	Cumulative Percent
Strongly agree	7	24.1	24.1
Agree	20	69.0	93.1
Neutral	1	3.4	96.6
Disagree	1	3.4	100.0
Total	29	100.0	

Table 4.9 shows that 93.1% of the project team participants either strongly agreed or agreed that teamwork save project time, thus ensuring projects are completed in time. Only 3.4% disagreed. Since teamwork is an element of collaborative participation, these findings imply that collaborative participation is positively related to quality delivery of small-size design building to the extent that teamwork reduces time wastage. Otherwise, a disjointed team could delay projects, thus jeopardizing the quality of project delivery.

Table 4.10*Distribution for 'Collaboration Saves Project Time' for Project Team*

	Frequency	Percent	Cumulative Percent
strongly agree	19	65.5	65.5
Agree	8	27.6	93.1
Neutral	1	3.4	96.6
Disagree	1	3.4	100.0
Total	29	100.0	

Table 4.10 indicates that 93.1% of the project team participants either strongly agreed or agreed that collaboration saves project time, thus ensuring projects are completed in time. Only 3.4% disagreed.

Table 4.11*Distribution for 'Collaboration Saves Cost' by Project Owners*

	Frequency	Percent	Cumulative Percent
strongly agree	8	32.0	32.0
Agree	14	56.0	88.0
Neutral	2	8.0	96.0
Disagree	1	4.0	100.0
Total	25	100.0	

As indicated in table 4.11, 88% of project owner participants agreed that collaborative approach to project delivery saves project cost while 4% disagreed. The remaining 8% opted not to respond to the item. Thus, collaborative participation influences the quality delivery of small-size design projects to the extent that it saves costs. If costly and high-risk collaboration or partnerships are formed, project cost might be escalated out of

owners' reach, thus jeopardizing the quality delivery of projects. Such collaboration would be detrimental to project quality.

Table 4.12

Spearman's Rho for Collaborative Problem Solving and Satisfaction with Project Safety for Project Owners

			Collaborative problem-solving	Satisfaction with project safety
Spearman's rho		Correlation	1.000	.498*
	Collaborative	problem- Coefficient		
	solving	Sig. (1-tailed)	.	.001
		N	25	25
Satisfaction with project safety		Correlation	.001	1.000
		Coefficient		
		Sig. (1-tailed)	.498*	.
		N	25	25

*. Correlation is significant at the 0.05 level (1-tailed).

Table 4.12 indicates a Spearman's rho value of 0.498 for collaborative problem solving, which is an element of collaborative participation and satisfaction with project safety, implying a weak positive relationship between collaborative problem solving, thus collaborative participation, and project safety satisfaction levels.

Table 4.13*Spearman's Rho for Consultative Meetings and Satisfaction with Project Time for Project**Owners*

			Satisfaction with project time	Frequency of consultative meetings
Spearman's rho	Satisfaction with project time	Correlation Coefficient	1.000	.171
		Sig. (1-tailed)	.	.206
		N	25	25
	Frequency of consultative meetings	Correlation Coefficient	.171	1.000
		Sig. (1-tailed)	.206	.
		N	25	25

Table 4.13 shows a weak positive relationship between frequency of consultative meetings and the level of satisfaction with project safety, indicated by a Spearman's rho value of 0.171. This finding implies that consultative meetings contribute, even though slightly, to the safety of small-size housing projects in Kasarani Constituency, further supporting the positive correlation between collaborative participation and quality delivery of small-size design-build projects.

Table 4.14*Spearman's Rho for Effects of Multidisciplinary Teams and Satisfaction with Project Safety*

			Satisfaction with project safety	Presence of Multidisciplinary
Spearman's rho		Correlation	1.000	.238
	Satisfaction with project safety	Coefficient		
		Sig. (1-tailed)	.	.126
		N	25	25
	Presence of Multidisciplinary teams	Correlation	.238	1.000
		Coefficient		
		Sig. (1-tailed)	.126	.
		N	25	25

Table 4.14 shows a weak positive correlation of 0.238 between multidisciplinary team formation and the level of satisfaction with project safety, further pointing to the positive relationships between collaborative participation and quality delivery of small-size design-build housing projects in Kasarani Constituency, Nairobi.

Table 4.15

Spearman's Rho for Satisfaction with Project cost and Collaborative Problem Solving for Project Team

		Satisfaction with cost	Collaborative problem-solving
Spearman's rho	Correlation	1.000	.297
	Satisfaction with project cost		
	Coefficient		
	Sig. (1-tailed)	.	.059
	N	29	29
Collaborative problem solving	Correlation	.297	1.000
	Coefficient		
	Sig. (1-tailed)	.059	.
	N	29	29

Table 4.15 shows a weak positive relationship of 0.297 between the level of satisfaction with cost and collaborative problem solving among project team members. This Spearman's rho value shows that collaborative participation, through collaborative problem-solving, improves the quality delivery of small-size design construction projects in Kasarani Constituency to the extent that the budgeted cost is not exceeded.

Table 4.16

Spearman's Rho for Satisfaction with Project Time and Use of Cross-Functional Teams for Project Team

		Satisfaction with use of cross- project time functional teams	
	Correlation	1.000	.288
Satisfaction	with Coefficient		
project time	Sig. (1-tailed)	.	.065
	N	29	29
Spearman's rho	Correlation	.288	1.000
Use of cross-	Coefficient		
functional teams	Sig. (1-tailed)	.065	.
	N	29	29

A Spearman's rho value of 0.288 shows a weak positive correlation between the level of satisfaction with project time and the use of cross-functional teams for project team participants. Thus, chances of quality delivery of design-build project increase with more cross-functional teams being established and supported in their roles.

Table 4.17*Spearman's Rho For Satisfaction with Project Cost and Frequency of Consultative Meetings*

			Satisfaction with project cost	Frequency of Consultative meetings
Spearman's rho	Satisfaction with project cost	Correlation Coefficient	1.000	.369*
		Sig. (1-tailed)	.	.024
		N	29	29
Spearman's rho	Frequency of consultative meetings	Correlation Coefficient	.369*	1.000
		Sig. (1-tailed)	.024	.
		N	29	29

*. Correlation is significant at the 0.05 level (1-tailed).

Table 4.17 shows significant positive relationship (Spearman's rho value of 0.369) between collaborative participation, through the frequency of consultative meetings, and satisfaction with project quality. At the 0.05 level, using a one-tailed test, the calculated value of +0.369 is greater than the critical value at +0.3115, so the hypothesis;

H₁₂ There is significant relationship between collaborative project participation and the quality delivery of small-size Design-Build housing projects in Kasarani Constituency is not rejected.

4.4.3 Concurrent Project Processes and Quality Delivery of Design-Build Projects

When project processes and activities are delivered simultaneously, projects stand to avoid defects, corrections and cancellations as each element or component of a project are fitted at the right time and with the right components.

Table 4.18

Distribution for 'Work Allocation Based on Worker Expertise Promotes Concurrent Project Processes' for Project Teams

	Frequency	Percent	Cumulative Percent
strongly agree	8	27.6	27.6
Agree	16	55.2	82.8
Neutral	1	3.4	86.2
Disagree	4	13.8	100.0
Total	29	100.0	

Table 4.18 shows that 27.6% of the project team respondents strongly agreed while 55.2% agreed that task allocation based on workers' expertise promotes concurrent project processes and products. 52.2% agreed that task allocation based on expertise positively influences project concurrent processes and products. Only 13.8% disagreed. Thus, concurrent processes, achieved through allocation of tasks based workers' expertise, promotes the quality delivery of non-defect products within the time and cost constraints.

Table 4.19

Distribution for 'Multidisciplinary Teams Promote Concurrent Processes' for Project Teams

	Frequency	Percent	Cumulative Percent
strongly agree	7	24.1	24.1
Agree	20	69.0	93.1
Disagree	2	6.9	100.0
Total	29	100.0	

From Table 4.19, 93.1% of project team participants agreed, to differing extents, that the formation and use of multidisciplinary teams in construction projects promote concurrent project processes and products. 6.9 percent disagreed that multidisciplinary team promotes concurrent processes in projects.

Table 4.20

Spearman's Rho for Multidisciplinary Teams and the Level of Satisfaction with Project Time

		Satisfaction with project time	Existence of multidisciplinary teams
Spearman's rho	Satisfaction	Correlation Coefficient	1.000
	with project	Sig. (1-tailed)	.325*
	cost	N	.028
	Frequency of	Correlation Coefficient	29
	consultative	Sig. (1-tailed)	.325*
	meetings	N	.028
			29

Table 4.20 shows significant positive relationship (Spearman’s rho value of 0.325) between concurrent project processes, through the indicator of multidisciplinary teams, and satisfaction with project quality through the indicator of time. At the 0.05 level, using a one-tailed test, the calculated value of +0.325 is greater than the critical value at +0.3115, so the hypothesis;

H₁₃ There is significant relationship between concurrent project processes and the quality delivery of small-size Design-Build housing projects in Kasarani Constituency, is not rejected.

4.4.4 Transparency and Quality Delivery of Design-Build Projects

A quality and safe housing project would be difficult to deliver if all stakeholders are not transparent, especially with regards to information and the requirements and regulations pertaining to a project.

Table 4.21

Distribution for ‘Sharing Information Saves Project Time’ for Project Teams

	Frequency	Percent	Cumulative Percent
strongly agree	10	34.5	34.5
Agree	19	65.5	100.0
Total	29	100.0	

From table 4.21, all project team respondents were unanimous that sharing of information saves project time with 34.5% strongly agreeing and 65.5 just agreeing.

Table 4.22

Distribution for 'Information Sharing Saves Project Time' by Project Owners

	Frequency	Valid Percent	Cumulative Percent
strongly agree	10	40.0	40.0
Agree	13	52.0	92.0
Disagree	2	8.0	100.0
Total	25	100.0	

In table 4.22, 92% of project owners agreed that sharing information saves time with 40% strongly agreeing to the research statement. The 8% that disagreed could reflect the tendency of some project owners to conceal certain vital information from their teams, prompting them to disagree with the questionnaire item. Transparency, through sharing of information, influences the quality delivery of small-size design-build projects by availing vital information in time. If information is shared through slow or bureaucratic channels, it would waste time, rendering such relay of information detrimental to the quality delivery of small design-build projects.

Table 4.23

Frequencies for 'Information Accessibility' for Project Teams

	Frequency	Percent	Cumulative Percent
very accessible	11	37.9	37.9
not easily accessible	15	51.7	89.7
Inaccessible	3	10.3	100.0
Total	29	100.0	

Table 4.23 shows that 37.9% of project team respondents felt information was very accessible in their projects, hence high transparency. 51.7% of the project teams interviewed felt that information was not easily accessible in their projects, thus jeopardizing the timely delivery and safety of products since owners could be hiding information vital for the implementation of the project. In fact, 10.3% of the project team respondents felt that information was inaccessible in their projects, derailing project progress, consequently jeopardizing product quality.

Table 4.24

Distribution for 'Effects of Clear Communication on Project Activities' for Project Teams

	Frequency	Valid Percent	Cumulative Percent
completed on time	21	72.4	72.4
completed earlier than planned	8	27.6	100.0
Total	29	100.0	

Table 4.24 shows that 72.4% of the project team participants responded that their project activities were completed on time while 27.6% responded that project activities were completed earlier than planned, because of clear communication from Owners and amongst

team members. Thus, transparency, through clear communication, ensures projects are delivered in time, showing that transparency improves quality by clear and timely sharing of vital information.

Table 4.25

Spearman’s Rho for Satisfaction with Project Cost and Sharing of Information by Project

<i>Team</i>			Satisfaction	with Information
			project cost	sharing
Spearman's rho	Satisfaction with project cost	Correlation	1.000	-.056
		Coefficient		
		Sig. (1-tailed)	.	.386
		N	29	29
	Information sharing	Correlation	-.056	1.000
		Coefficient		
Sig. (1-tailed)		.386	.	
	N	29	29	

Table 4.25 indicates a Spearman’s rho of -0.056 for information sharing and satisfaction with project cost. This figure implies that information sharing has a weak negative relationship with the cost and quality requirements being met. However, concealing vital safety or system information from workers could still result in substandard projects, making projects costly.

Table 4.26

Spearman's Rho for Satisfaction with Safety and Information Accessibility by Project Team

		Project safety	Information
		satisfaction	accessibility
Spearman's rho	Correlation Coefficient	1.000	.433*
	Project safety satisfaction	Sig. (1-tailed)	.033
		N	29
	Information accessibility	Sig. (1-tailed)	.433
		N	29
		Correlation Coefficient	.033

*. Correlation is significant at the 0.05 level (1-tailed).

Table 4.26 shows a positive and significant Spearman's rho value of 0.433 for the relationships between transparency, through information accessibility, and satisfaction with project safety. Transparency thus influences the quality delivery of small-size design-build housing projects in Kasarani Constituency to the extent that safety information is clear and delivered in time. From the obtained Spearman's rho value in table 4.26, the hypothesis;

H₁₄ There is significant relationship between transparency and the quality delivery of small-size design-build housing projects in Kasarani Constituency is not rejected.

4.4.5 Risk-Sharing and Quality Delivery of Design-Build Projects

Sharing risks and working with risk management experts are the other practices believed to be instrumental in the delivery of quality small-size design-build housing projects. Otherwise, project teams working without sharing risks and advice from risk experts stand to overlook many safety and risk mitigation measures.

Table 4.27

Distribution for 'Working With Risk Experts Prevents Cost Escalation' for Owners

	Frequency	Valid Percent	Cumulative Percent
Yes	12	48.0	48.0
No	13	52.0	100.0
Total	25	100.0	

Table 4.27 shows that 48% of the projects team members felt that working with risk experts prevent project cost from escalating. Risk-sharing influences the quality delivery of small design-build projects to the extent that risk experts are in able to identify the risks in time and to mitigate them, thus reducing cost escalation.

Table 4.28

Spearman's Rho for Satisfaction with Project Safety and Task Allocation on the Basis of Expertise and Skills by Project Owners

			Satisfaction with project safety	Task allocation based on expertise and skills
Spearman's rho	Satisfaction with project safety	Correlation Coefficient	1.000	.382*
		Sig. (1-tailed)	.	.097
		N	25	25
	Task allocation based on skills and expertise	Correlation Coefficient	.097	1.000
		Sig. (1-tailed)	.382	.
		N	25	25

*. Correlation is significant at the 0.05 level (1-tailed).

Table 4.28 shows that task allocation based on workers' levels and types of expertise and skills are positively related to the level of satisfaction with project safety, with a Spearman's rho value of 0.382). Risk-sharing, through task allocation based on skills, promotes project safety by effective and timely risk identification, monitoring, evaluation and prevention. Thus, small-size design-build construction projects in Kasarani Constituency should work with risk management experts to build quality and safe and inhabitable houses.

Table 4.29

Spearman's Rho for Satisfaction with Project Cost and Working with Risk Experts by Project

Owners

			Satisfaction with project cost	Working with risk experts
Spearman's rho		Correlation Coefficient	1.000	.387*
	Satisfaction with project cost	Sig. (1-tailed)	.	.083
		N	25	25
		Correlation Coefficient	.083	1.000
	Working with risk experts	Sig. (1-tailed)	.387	.
		N	25	25

*. Correlation is significant at the 0.05 level (1-tailed).

The Spearman's rho value of 0.387 in table 4.29 shows a positive relationship between satisfaction with project cost and working with risk experts on the other. Thus, risk-sharing by working with risk experts, positively influences the quality delivery of small design-build housing projects in Kasarani Constituency to the extent working with experts do not excessively increase project cost.

Table 4.30

Spearman's Rho for Satisfaction with Project Safety and Risk Strategy Implementation for Project Teams

		Satisfaction with project safety	Risk strategy implementation	
Spearman's rho	Correlation	1.000	.480*	
	Satisfaction with project safety	Coefficient		
		Sig. (1-tailed)	.010	
		N	29	
	Risk strategy implementation	Correlation	.010	1.000
		Coefficient		
	Sig. (1-tailed)	.480	.	
	N	29	29	

*. Correlation is significant at the 0.05 level (1-tailed).

As indicated in table 4.30's Spearman's rho value of 0.480, which is far greater than the critical value of 0.381 for single-tailed study at 0.05 level of significance, for risk strategy implementation and project safety, there exists a significant positive relationship between satisfaction with project safety and risk strategy implementation. The implication of this finding is that risk-sharing, working with risk experts and the implementation of risk strategies in small design-build construction projects significantly relates to project safety and cost, thus the overall quality delivery of projects.

From these analyses, the hypothesis;

H₁₅ There is significant relationship between risk-sharing and the quality delivery of small-size design-build housing projects in Kasarani Constituency is not rejected.

CHAPTER FIVE

SUMMARY OF THE FINDINGS, DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter contains a summary of the findings of the study, discussions, conclusions, recommendations and suggestions for further studies. It also contains references and appendices that contributed to this study.

5.2 Summary of Findings

The study findings show that quite many factors contribute to the quality of small-size design-build housing projects in Kasarani Constituency. In particular, most of these factors are associated with and should be accounted for during the delivery of the projects. The studied variables, namely object-oriented technology, collaborative participation, concurrent project processes, transparency and risk-sharing, have all been found to influence the quality, thus the safety of small-size housing projects. In fact, all these factors have been established to have positive relationship with different aspects of project quality. Of great interest for this study was the relationship between these independent variables and the quality delivery of small-size build-design housing projects.

5.2.1 Object-Oriented Technology and the Quality Delivery of Design-Build Projects

As more modern and object-oriented technology is used, the quality and safety of the projects increase. Although the opinions of project workers and project owners varied slightly on some aspects of object-oriented technology, there was concurrence that it is essential in the delivery of quality, safe and inhabitable small-size housing projects in Kasarani Constituency, Nairobi. In fact, as indicated in table 4.5, 76% of the participating project owners agreed that technology use promotes project safety.

With a Spearman's Rho value of 0.393 for the ease of technology use and the level of satisfaction with project cost, there is evidently significant positive relationship between object-oriented technology and the quality delivery of small-size design-build housing projects in Kasarani Constituency, Nairobi.

5.2.2 Collaborative Participation and the Quality Delivery of Design-Build Projects

In many design-build housing projects, partnership is often non-contractual. Thus, such projects are marred by non-collaboration from some stakeholders. The findings of this study show a positive relationship between project quality and safety on one hand and collaborative participation on the other. Consultative meeting, teamwork and collaborative problem-solving are the main practices that support collaboration.

With a Spearman's rho value of 0.498 for collaborative participation, through collaborative problem solving, and the level of satisfaction with project safety, there is clearly a significant relationship between collaborative participation and the quality delivery of design-build housing projects in Kasarani Constituency, Nairobi.

5.2.3 Risk Sharing and the Quality Delivery of Design-Build Projects

On the effects of risk sharing on project quality, a Crosstabulation Spearman's rho value of 0.322 shows a positive relationship between job allocations based on worker skills and expertise and level of satisfaction with project safety. A Spearman's rho value of 0.347 between working with risk experts and satisfaction with project safety shows a positive relationship between risk-sharing and the quality delivery of small-size design-build housing projects in Kasarani Constituency. Hence, working with risk experts and allocation of tasks based on project team area of expertise and skills greatly influence project quality through improved safety and inhabitability.

5.2.4 Concurrent Project Processes and the Quality Delivery of Design-Build Projects

Implementing project processes, activities and products concurrently has also been shown, by the findings, to influence the quality and safe delivery of small-size design-build housing projects in Kasarani constituency. The results indicate that project teams and project owners agree that multidisciplinary teams promote concurrent project processes with a higher percent (93%) of project team members than project owners (84%) agreeing to the questionnaire item. Seemingly, project workers appreciate the importance of multidisciplinary teams more than project owners do. The former group forms these teams hence their appreciation of multidisciplinary teams.

5.2.5 Transparency and the Quality Delivery of Design-Build Projects

It was found that 65.5% of the respondents agreed that sharing information saves project cost while 52% agreed that information sharing saves project cost. A nonparametric analysis of information accessibility and satisfaction with project safety gave a Spearman's rho value of 0.433, implying a positive relationship between information accessibility or transparency and satisfaction with project quality.

5.3 Discussions

This section discusses the results of the study, comparing and contrasting the findings with the results of other studies, giving and explaining the similarities and differences.

5.3.1 Object-Oriented Technology and the Quality Delivery of Design-Build Projects

The use of technology has far-reaching implications for the quality delivery of housing projects. Rather than use basic technologies merely to save cost, project owners and managers ought to use the latest and the best technology that would create quality projects. In this study, 86.2 percent of project team participants reported that the technologies used in their projects was quite easy to use. Reportedly, project owners opt for the cheapest and most basic technologies to reduce cost, ignoring project quality. This finding is unlike that of Stagner (2008), which established that most project owners in Texas use modern BIM and related technologies as alternatives to the basic technologies used in Kenya.

The technologies in use in small-size housing constructions in Kasarani are basic and are related to cement, sand, concrete, metal bars and stone, explaining the ease of use for many workers. In other terms, no respondent listed modern technologies such as Building Information Modelling (BIM), Computer-Assisted Design (CAD), 4D or 3D technologies. These findings are different from findings by Ritchet (2013) in which projects in more developed UE and North American countries use computer software such as Building Information Modelling (BIM) technologies to design projects and check system compatibility and quality. Ritchet (2013) also found out that modern technologies such as CAD and BIM are extensively used in bigger design-bid-build projects.

In this study, an overwhelming 96.6% agreed that technology increases project speed, albeit to different extents. The study also shows that in Kasarani Constituency, most stakeholder associated technology with high project cost. (Ritchet, 2013) recommends that appropriate technology is a pillar of project quality and success, evidenced by the many projects he studied and found to have applied advanced technologies such as BIM, CAD and 3D technology. For quality, safe and inhabitable housing projects, cutting edge technology is a requisite. According to Barbara (2010), the technology used should be identified at project inception for purposes of functionality maximization. Early specification of project

technology is valuable for project interoperability. The chosen technology must be open and interoperable and should be built on transparent and disciplined data structures (Barbara, 2010). Finally, the technology must be compliant with local and international industry standards to support safety and communication (Malik, 2002).

5.3.2 Collaborative Participation and the Quality Delivery of Design-Build Projects

It is evident from the results that collaboration is important in the efficient and quality delivery of small-size housing projects in Kasarani, regardless of how prepared and equipped a project team. According to O'Connor's (2009) findings, without collaborative partnership by stakeholder, the delivery of quality and safe small-size projects remains elusive. Working in isolation is likely result in uncoordinated and substandard housing projects, jeopardizing the cost, time and safety standards of projects.

The results reveal that teamwork is a key method of collaboration in small-size design-build housing projects in Kasarani Constituency. A majority of the participants either 'strongly agreed' or 'agreed' that teamwork and collaboration save project pace, thus ensuring the timely completion of projects.

The respondents also supported the notion that there exists a positive relationship between collaborative problem solving and project safety satisfaction levels in small-size design-build housing projects in Kasarani Constituency. Similarly, there is a positive relationship between consultative meetings and satisfaction with project safety. That is, an increase in the number and intensity of consultative meetings results in an increase in the level of satisfaction with project safety. There is also a positive correlation between the formation and use of multidisciplinary teams and satisfaction with project safety. Collaborative solution of project problems also promotes the delivery of projects within the monetary, time and safety requirements.

Similar to the findings of this study, O'Connor, (2009) established that collaborative problem solving and the use of consultative meetings reduce project errors, omissions and design modifications to levels lower than in situations without collaborative participation. This study, like that by O'Connor (2009), increases stakeholder confidence in the benefits of collaborative project delivery methods such as the Integrated Project Delivery (IPD). In addition, it is expected that the study's results might encourage the acceptance of collaboration for quality public projects.

O'Connor (2009) established that effective collaboration that would result in quality delivery of housing projects requires the use of contract forms, an idea, which is fast spreading in other regions and countries such as the USA. However, such contract forms are not used in small-size housing projects in Kasarani Constituency. In fact, collaborative participation in the Kasarani housing projects is based purely on trust and mutual respect among stakeholders. Collaboration should target people, processes and promises, a feature that is lacking in the case of Kasarani Constituency housing construction sector. As Malik (2002) also recommends, for effective collaboration, the right team should be selected, managed well and motivated. Malik (2002) summarizes by encouraging the adoption of IPD contracts for successful collaborative undertakings.

5.3.3 Concurrent Project Processes and the Quality Delivery of Design-Build Projects

The findings of this study reveal that task allocation based on workers' expertise promotes concurrent project processes and products members know when their skills are required and at what point they should come in for different components of a system. It was also established that the formation and use of multidisciplinary teams in the construction of small-size housing projects in Kasarani Constituency promote synchronized project processes and products. Both categories of participants acknowledged the importance of concurrent

project processes and activities in the delivery of quality and safe housing projects for human inhabitation.

The literature review concurred that when project processes and activities are delivered simultaneously, projects suffer fewer or no defects, corrections and cancellations because each component of a project's system is fitted at the right time and with the right components (O'Connor, 2009).

At the global level and in the larger construction industry, many partners, especially project engineers have embraced the integration of processes to improve project delivery (Malik, 2002). O'Connor (2009) established that at the international level, engineers have embraced concurrent engineering, which lacks in small projects at the local scene, as is evidenced by the basic technologies used in local projects. As Malik (2002) advises, concurrent engineering, which is a systematic approach to engineering that focuses on an integrated and concurrent designing of project processes (manufacture and support) and products, should be promoted at the local scene. In concurrent engineering, project partners take into account all the elements of quality, schedule, cost and user requirements of project life cycle (O'Connor, 2009).

5.3.4 Transparency and the Quality Delivery of Design-Build Projects

The study revealed that the participants appreciated the importance of transparency in the delivery of quality or safe housing projects in Kasarani Constituency. If stakeholders, especially project owners and main contractors are not transparent and forthcoming with information about all the requirements, regulations and other aspects of the project, quality is bound to be compromised. In this study, the majority of owners and project team respondents opined that sharing of information saves project time, ostensibly because there are no delays due to lack of the requisite information. However, some respondents said that adequate

information sharing lacks in their projects, reflecting the tendency of some project owners to conceal certain vital information from their team.

A majority of the respondents felt that information is not easily accessible in their projects, greatly jeopardizing the safety of the product because owners might be hiding information vital to the quality delivery of the projects. The reported completion of projects earlier than initially planned could imply substandard or hurriedly completed projects with unmet safety requirements. The study findings concur with the findings of a study by Koltz(2011) that information sharing and information accessibility positively relate with the levels of project safety and timely completion (Koltz, 2011). According to this study, the more information is shared among project stakeholders, the higher the likelihood of a safety and quality requirements to be met. Anumba and Nosa (1997) also established that hiding important project information from stakeholders could result in substandard projects.

The findings of this study on small-size housing projects in Kasarani Constituency are in tandem with the findings of Koltz (2011) who established that imperfect process transparency is commonplace in single organization and private projects. As Kotlz (2011) noted, process transparency is quite important at the project-level for project partners engaged in unfamiliar processes. As noted by Anumba and Nosa (1997), design-build approach should encourage transparency to enhance its myriad advantages such as short lead times, contractor involvement in design processes, greater cost certainty, more effective communication and shorter construction time.

Stakeholders in the small-size housing sector in Kasarani Constituency are thus advised to take up the project delivery model that Anumba and Nosa (1997) proposes. This model emphasizes concurrent project design and implementation via the integration of all participants in a multi-pronged and multi-functional team matrix. This team matrix promotes the resolution of all likely downstream challenges at the early phases of a project life cycle.

Through a design function deployment and an engineering design system that supports concurrent processes, projects would have formal mechanisms for improving abstractions of client requirements.

5.3.5 Risk-Sharing and the Quality Delivery of Design-Build Projects

Sharing risks and working with risk management experts is core to the delivery of quality small-size design-build housing projects in Kasarani Constituency. With shrewd risk sharing and project teams working with and receiving advice from risk experts, it would be easy to identify the risk hazards to which projects are exposed. Consequently, the right mitigation measures would be implemented. In this study, 48% of the projects team respondents felt that working with risk experts helped their projects avoid cost escalation. Moreover, task allocation based on workers' levels and types of expertise and skills was shown to be associated with increased satisfaction with project safety. Hence, to augment project safety by effective risk management, project owners should work with risk management experts to build safe and inhabitable houses. The implementation of safety and risk strategies in construction projects considerably influences the safety and the overall quality delivery of such projects.

In this study, fewer project owners are satisfied with the speed than those satisfied with the usability. A possible explanation could be that many project owners are often in a hurry to complete their projects, at the expense of quality and safety. However, 88% of the participating owners were satisfied with the safety of their products, implying these projects might have met the safety standards and regulations in the industry.

The small-size housing construction sector in Kasarani constituency lacks certain practices that would encourage risk sharing. For instance, they do not practice risk-pooling, an approach that AIA (2012b) established in its studies in large-size projects in the USA.

Hence, project teams in Kasarani's small size design-build housing projects should participate in risk-pools by placing certain percentage of their profits to partially offset any risks associated with project cost overruns and other liabilities. The study by AIA (2012b) established that risk-pooling provides for incentives in form of payments in case project teams achieve actual project costs or incur lower costs.

5.4 Conclusions

From the findings of the study, it is evident that quite a number of factors contribute to the quality of small-size design-build housing projects. In particular, the findings explain the higher proportion of collapsing small-size houses in Kasarani Constituency, Nairobi. Whereas the stakeholders of these projects use technologies during technologies during the implementation, these technologies are quite basic and only relate to cement, stock, concrete and communication among project teams. Advanced technologies that ensure project concurrence, safety and integration such as BIM, 4D and 3D designs and computer-aided design are rarely, if ever, used. Hence, the quality and safety of these projects are not assured. Often, project owners want to cut costs, prompting them to ignore modern technologies that can ensure the delivery of quality and safe housing projects.

Collaboration is reportedly being practice in small-size design-build housing projects in Kasarani Constituency. However, in some of the projects, owners do not share vital information to workers, especially information on finances and the quality of the materials being used. A lot of information is also not accessible to workers, who only receive instruction on what to do on-site. Thus, transparency lack in quite a number of small size design-build housing projects in Kasarani. Some projects have also not embraced the concept and models of concurrent project processes and products, which ensures all the elements of a system or a structure fit well and at the right time. The idea of concurrent project processes

ensures safety by eliminating or reducing errors, omission and corrections, which have negative effects on project safety. Formation of multidisciplinary teams, consultative meetings and collaborative problem solving are some of the techniques by which collaboration and concurrent project processes can be achieved.

In many instances, risk management experts are not involved or consulted on how to identify, monitor, assess, plan for and mitigate project risks. In addition, risk-sharing through risk-pools by partners is not practiced. All these tendencies influence the quality delivery of housing projects negatively, jeopardizing their safety. The use of outmoded technologies, non-collaboration among project stakeholders, lack of transparency, non-concurrent project processes or activities and tendencies to ignore risk management experts greatly contribute to the substandard and unsafe housing projects in Kasarani Constituency.

5.5 Recommendations for Policy Action

The following policy recommendations may be useful for the delivery of quality, safe and inhabitable small-size houses in Kasarani Constituency.

1. Adoption of an integrated project delivery (IPD) approach to project implementation by stakeholders in the small-size design build sector
2. The adoption and use of modern technologies such as Building Information System, CAD, 4D and 3D designs
3. Inculcation of a culture of collaborative participation, characterized by the use of the relevant contract forms to ensure all stakeholders are conversant with their mandate and importance to the project
4. Embrace risk management practices such as risk identification, quantification, monitoring and mitigation to help prevent risks and improve quality (safety)

5. Work with and seek advice from risk management experts on practices such as risk-pooling to protect stakeholders
6. Embrace transparency through information accessibility, clarity, accuracy and sharing

5.5.1 Suggested Areas for Further Studies

Clearly, little has been done at the local scene concerning the project delivery-related factors that influence the quality of small-size housing projects. Hence, further studies should focus on the influence that team integration and models such as the Integrated Project Delivery practices have on the quality delivery of housing projects. More studies should focus on factors such as object-oriented technology, collaborative participation, concurrent project processes and activities, risk-sharing and transparency and their influence on small-size design-build projects.

5.6 Contribution to the Body of Knowledge

This study has contributed to the body of knowledge on the importance of several factors of project delivery on the quality and safety of small-size housing projects. Given that most of the available literatures focus on big design-bid-build projects such as hospitals and government structures, this study brings a wealth of knowledge on the applicability of the principles of quality and integrated project delivery to small-size housing projects and other small projects. In other terms, the principles of Integrate Project Delivery, often associated with big multi-billion shilling-projects, can also be applied to small projects. Unfortunately, the study reveals that factors that promote integration such as collaborative participation, concurrent project processes, risk-sharing, transparency and object-oriented technology are ignored in small-size and design-build projects, in which partnership is often based on trust and mutual respect.

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Appendix (i): Letter of Introduction



UNIVERSITY OF NAIROBI
COLLEGE OF EDUCATION AND EXTERNAL STUDIES
SCHOOL OF CONTINUING AND DISTANCE EDUCATION
DEPARTMENT OF EXTRA-MURAL STUDIES
NAIROBI EXTRA-MURAL CENTRE

Your Ref:

Our Ref:

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Main Campus
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P.O. Box 30197
NAIROBI

14TH APRIL 2015

REF: UON/CEES//NEMC/21/080


TO WHOM IT MAY CONCERN

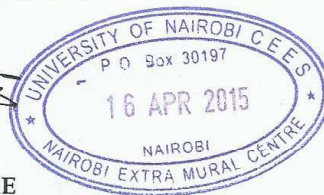
RE: ODHIAMBO IDDI JUMA - REG NO - L50/69430/2013

This is to confirm that the above named is a student at the University of Nairobi, College of Education and External Studies, School of Continuing and Distance Education, Department of Extra- Mural Studies pursuing Master of Arts in Project Planning and Management.

He is proceeding for research entitled "factors influencing the quality delivery of design-build projects: A case of small-size housing projects in Kasarani Constituency, Nairobi Kenya.

Any assistance given to him will be appreciated.


CAREN AWILLY
CENTRE ORGANIZER
NAIROBI EXTRA MURAL CENTRE



Appendix (ii): Questionnaire for Project Owners

QUESTIONNAIRE FOR PROJECT OWNER

Introduction

My name is IddiOdhiambo, a student of the University of Nairobi studying Masters of Arts in Project Planning and Management. This study is committed to the safety and quality delivery of housing project and owner satisfaction by the adoption of integration-oriented approaches. Through this survey, your responses may promote the use of the principles and practices of integration to meet the quality and safety expectations of small-size housing project owners. Your responses will only be used for the purposes of this study. In case you have any questions regarding the survey, please call me on 0726584209 or email at otayomafta2006@gmail.com. Thanks for your time and responses.

PART A: Object-Oriented Technology and Quality Delivery of Design-Build Projects

1. What technologies are used in this project?

.....
.....

2. The use of technology greatly influences project's

(Use the key below to tick the appropriate box)

	1	2	3	4	5
3. Construction speed and time					
4. Project unit cost					
5. Quality					
6. Project safety					
7. Usability					

1= To a great extent, 2= Moderate extent, 3= Does not influence, 4= No comment

8. What communication technologies are used in the project?

.....
.....

9. How would you describe the flow of documentation and communication in your

project?

Fast

Moderate

Slow

No comment

10. Does the technology used promote concurrent project processes or/and activities?

Yes

No

PART B: Collaborative Project Participation and Quality Delivery of Design-Build Projects

(In the following questions, please indicate your response by a tick in the appropriate box)

11. Do you practice collaborative problem-solving with the project team?

Yes

Sometimes

Rarely

No

12. Collaboration in solving problems saves the Unit Cost of the project

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

13. Collaboration in solving problems saves project construction time

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

14. Do you share information with other partners in the project?

- Yes
- No

15. Which methods are used to send and share information to the project team?

.....

.....

.....

16. Sharing information with workers helps save project construction time (Indicate appropriately)

- Strongly agree

- Agree
- Neutral
- Disagree
- Strongly Disagree

17. How often do you hold consultative meetings?

- Once a week
- When necessary
- Once a month
- Twice a month
- Rarely

PART C: Concurrent Project Processes and Quality Delivery of Design-Build Projects

18. Have you created cross-functional teams in your housing project?

- Yes
- No
- No comment

19. Forming multidisciplinary teams results in concurrent product realization for your project

- Strongly agree
- Agree
- Neutral

Disagree

Strongly Disagree

20. Allocation of tasks based on workers' skills and expertise results in concurrent product realization

Strongly agree

Agree

Neutral

Disagree

Strongly Disagree

21. Team work has reduced time wastage in project implementation

Strongly agree

Agree

Neutral

Disagree

Strongly Disagree

PART D: Transparency and Quality Delivery of Design-Build Projects

22. How would you describe information accessibility by the project team?

Very accessible

Not easily accessible

Inaccessible

23. What methods do you use to share information with the project team?

.....
.....
.....

24. Information is easily disclosed to other project participants

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

25. What is the effect of clear communication with workers on the project's activities?

- Completed on time
- Completed earlier than planned
- Delayed
- No Effects

26. How accurate is the information disseminated to project team?

- Very accurate
- Moderately accurate
- Not accurate

PART E: Risk-Sharing and Quality Delivery of Design-Build Projects

27. Which risk identification activities are practiced in your project?

.....
.....
.....

28. What risk mitigation measures have you put in place to ensure project safety?

.....
.....
.....
.....

29. What types of risks have you encountered in this project?.....

.....
.....

30. Do you engage in joint ventures to minimize risks?

Yes
No

31. Do you work with experts in risk management in your project?

All the time
Sometimes
Rarely
No
No Comment

32. Does working with risk management experts prevent the unit cost from escalating?

Yes

No

PART F: Level of Satisfaction with Project Delivery Quality

How satisfied are you with the

	1	2	3	4	5
33. Construction speed and time					
34. Project unit cost					
35. Client satisfaction					
36. Project safety					
37. Usability					

Tick the appropriate box

1= extremely satisfied, 2=satisfied, 3=Neutral, 4=Dissatisfied, 5= extremely dissatisfied

Appendix(iii): Questionnaire for Project Team

QUESTIONNAIRE FOR PROJECT TEAM

Introduction

This project is committed to improving housing project performance and customer satisfaction by the delivery of quality projects by the adoption of integration-oriented approaches. Through this survey, your responses will be useful in promoting the use of the principles and practices of integration to meet the quality and safety expectations of small-size housing project owners. Your responses will only be used for the purposes of this study. Attached are approval letters from the University of Nairobi and the National Commission on Science, Technology and Innovation (NACOSTI). In case you have any questions regarding the survey, please call IddiOdhiamboJuma on 0726584209 or email at otaomafta2006@gmail.com. Thanks for your time and responses.

PART A: Object-Oriented Technology and Quality Delivery of Design-Build Projects

1 Your are:

Project owner

Project team (Contractor, Engineer, Subcontractor, Worker)

2. What technologies are used in this project?

.....
.....

3. Is the technology easy to use?

Yes

No

4. What communication technologies are used in the project?

.....
.....

5. How would you describe the flow of documentation and communication in your project?

Fast

Moderate

Slow

No comment

6. To what extent does the technology used increase work speed?

To a great extent

Moderate extent

Does not increase speed

No comment

7. The use of technology increases the cost of the project (Tick the appropriate box)

Strongly agree

Agree

Neutral

Disagree

Strongly disagree

8. The use of technology shortens project time (Please tick appropriately)

Strongly agree

Agree

Neutral

Disagree

Strongly Disagree

9. Does the technology used promote concurrent project processes or/and activities?

Yes

No

PART B: Collaborative Project Participation and Quality Delivery of Design-Build

Projects

10. Do you practice collaborative problem-solving in your project?

Yes

Sometimes

Rarely

No

(In the following questions, please indicate your response by a tick in the appropriate box)

11. Collaboration in solving problems saves the Unit Cost of the project

Strongly agree

Agree

Neutral

Disagree

Strongly Disagree

12. Collaboration in solving problems saves project construction time

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

13. Do you share information with other partners in the project?

- Yes
- No

14. Which methods are used to send and share information in the project?

.....

.....

.....

15. Sharing informationsaves project construction time (Indicate appropriately)

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

16. How often do you hold consultative meetings?

- Once a week
- Twice a week

Once a month

Twice a month

Rarely

PART C: Concurrent Project Processes and Quality Delivery of Design-Build Projects

17. Have you created cross-functional teams in your housing project?

Yes

No

Answer the following questions by ticking the appropriate box

18. Forming multidisciplinary teams results in concurrent product realization for your project

Strongly agree

Agree

Neutral

Disagree

Strongly Disagree

19. Allocation of tasks based on people's expertise results in concurrent product realization

Strongly agree

Agree

Neutral

Disagree

Strongly Disagree

20. Team work has reduced time wastage in project implementation

Strongly agree

Agree

Neutral

Disagree

Strongly Disagree

PART D: Transparency and Quality Delivery of Design-Build Projects

21. How would you describe information accessibility by the project team?

Very accessible

Not easily accessible

Inaccessible

22. If information is accessible, does this increase project speed?

Yes

No

23. Information is easily disclosed to other project participants (Tick the most appropriate

box)

Strongly agree

Agree

Neutral

Disagree

Strongly Disagree

24. What is the effect of clear communication on the project's activities?

- Completed on time
- Completed earlier than planned
- Delayed
- No Effects

25. How accurate is the information disseminated to project team?

- Very accurate
- Moderately accurate
- Not accurate

PART E: Risk-Sharing and Quality Delivery of Design-Build Projects

26. Which risk identification activities are practiced in your project?

.....
.....
.....

27. What types of risks have you encountered in this project?.....

.....
.....

28. Do you engage in joint ventures to minimize risks?

- Yes
- No

29. Do you work with experts in risk management in your project?

.....
.....

30. Does working with risk management experts prevent the unit cost from escalating?

Yes
No

PART F: Level of Satisfaction with Project Delivery Quality

How satisfied are you with the

	1	2	3	4	5
31. Construction speed and time					
32. Project unit cost					
33. Client satisfaction					
34. Project safety					
35. Usability					

Tick the appropriate box

1= extremely satisfied, 2=satisfied, 3=Neutral, 4=Dissatisfied, 5= extremely dissatisfied

Appendix (iv): Newspaper reports of collapsed buildings in Nairobi



Appendix (v): Critical Values for Spearman's Rank-Order Correlation Coefficient

Table D.5 *Values of Pearson's product moment correlation coefficient (r). The results are significant if the calculated value of r is higher than the table value*

df (n - 2)	r		df (n - 2)	r	
	P = 0.05	P = 0.01		P = 0.05	P = 0.01
1	0.997	1.000	16	0.468	0.590
2	0.950	0.990	17	0.456	0.575
3	0.878	0.959	18	0.444	0.561
4	0.811	0.917	19	0.433	0.549
5	0.754	0.874	20	0.423	0.537
6	0.707	0.834	21	0.413	0.526
7	0.666	0.798	22	0.404	0.515
8	0.632	0.765	23	0.396	0.505
9	0.602	0.735	24	0.388	0.496
10	0.576	0.708	25	0.381	0.487
11	0.553	0.684	26	0.374	0.479
12	0.532	0.661	27	0.367	0.471
13	0.514	0.641	28	0.361	0.463
14	0.497	0.623	29	0.355	0.456
15	0.482	0.606	30	0.349	0.449

Appendix (vi): Research Permit



**NATIONAL COMMISSION FOR SCIENCE,
TECHNOLOGY AND INNOVATION**

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Fax: +254-20-318245, 318249
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NAIROBI-KENYA

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Date:

8th May, 2015

NACOSTI/P/15/4297/5882

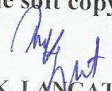
Iddi Odhiambo Juma
University of Nairobi
P.O Box 30197-00100
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on "*Factors influencing the quality delivery of build-design projects: A case of small-size housing projects in Kasarani Constituency, Nairobi, Kenya,*" I am pleased to inform you that you have been authorized to undertake research in **Nairobi County** for a period ending **30th October, 2015.**

You are advised to report to **the County Commissioner and the County Director of Education, Nairobi County** before embarking on the research project.

On completion of the research, you are expected to submit **two hard copies and one soft copy in pdf** of the research report/thesis to our office.


DR. S. K. LANGAT, OGW
FOR: DIRECTOR GENERAL/CEO

Copy to:

The County Commissioner
Nairobi County.

The County Director of Education
Nairobi County.

National Commission for Science, Technology and Innovation is ISO 9001:2008 Certified

<i>N</i>	<i>S</i>	<i>N</i>	<i>S</i>	<i>N</i>	<i>S</i>
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	375
160	113	800	260	20000	377
170	118	850	265	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	132	1000	278	75000	382
210	136	1100	285	100000	384

Note.—*N* is population size. *S* is sample size.

Source: Krejcie & Morgan, 1970

Appendix (vii): Krejcie and Morgan Table