CONSTRUCTION WASTE MANAGEMENT PRACTICES AND PERFORMANCE OF HOUSING AND WATER PROJECTS IN NAIROBI CITY COUNTY, KENYA

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SEPTEMBER, 2018
DECLARATION

I declare that this research project is my original work and it has not been submitted for the award of any degree or diploma in any other institution. No part of the project should be reproduced without the authority of the author and/or Kenyatta University.

Signature______________________________ Date _________________________

David Gitau
D53/CTY/PT/37125/2016

This research project is submitted for examination with my approval as the appointed university supervisor.

Signature______________________________ Date _________________________

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DEDICATION

This research project is dedicated to my wife and my children. Thank you for your love and support throughout this study.
ACKNOWLEDGEMENT

I do wish to acknowledge my supervisor Dr. Caleb Kirui and appreciate his efforts in guiding me through each step by sharing his powerful knowledge with me. I also wish to thank Kenyatta University fraternity for giving me the opportunity to be part of such a great institution.
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# ABBREVIATIONS AND ACRONYMS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>ANOVA</td>
<td>Analysis of Variance</td>
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<tr>
<td>CD</td>
<td>Construction and Demolition</td>
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<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
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<tr>
<td>KNBS</td>
<td>Kenya National Bureau of Statistics</td>
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<td>NCC</td>
<td>National Construction Corporation</td>
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<td>PPDA</td>
<td>Public Procurement and Asset Disposal</td>
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<td>SPSS</td>
<td>Statistical Package for Social Sciences</td>
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<td>TCA</td>
<td>Transaction Cost Analysis</td>
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<tr>
<td>UAE</td>
<td>United Arab Emirates</td>
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<td>UK</td>
<td>United Kingdom</td>
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OPERATIONAL DEFINITION OF TERMS

**Construction Waste**
Construction materials that are lost in transit on or off site, discarded without adding value to the project for which it was procured including overproduction or left over from newly constructed facility.

**Construction Waste Management Practices**
Refer to the method of eliminating waste where possible; minimizing waste where feasible; and reusing materials which might otherwise become waste.

**Construction Industry**
Sector of national economy engaged in preparation of land and construction, alteration, and repair of buildings, structures, and other real property.

**Project**
Planned set of interrelated tasks to be executed over a fixed period and within certain cost and other limitations.

**Performance**
The accomplishment of a given task measured against preset known standards of accuracy, completeness, cost, and speed.

**Material Cost**
The amount of money invested in the production of a product.

**Reduce**
To draw together or cause to converge

**Re-use**
Reintroduction of a by-product or waste material as an input into a manufacturing process, usually without any physical or chemical change
<table>
<thead>
<tr>
<th>Recycle</th>
<th>Process of converting waste materials into reusable materials and objects</th>
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<tr>
<td>Procurement</td>
<td>deals with the sourcing activities, negotiation and strategic selection of goods and services that are usually of importance to an organization.</td>
</tr>
<tr>
<td>Material Handling</td>
<td>Movement, protection, storage and control of materials and products throughout manufacturing, warehousing, distribution, consumption and disposal</td>
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The increase of construction activities due to development in developing countries increases the generation of construction waste. Effective waste management services can save business money and benefit the environment at the same time. However, the Nairobi City County faces many challenges to manage construction waste disposal such as insufficiently stringent legislation, poor enforcement, inadequate facilities and collection network, low public awareness and lack of capacity and negligent behaviour of local contractors due to lack of proper construction waste control and monitoring by the Nairobi City County. This study sought to investigate the influence of construction waste management practices on the performance of housing and water projects in Nairobi City County, Kenya. The study sought to establish how project design, procurement, material handling and reuse, reduce, recycle practices influence housing and water projects. A descriptive survey research design was used. 95 housing and water construction projects formed the target population. A census of 285 respondents was carried out. Questionnaire was used to collect primary data. Data was analysed using descriptive statistics and inferential statistics such as correlation analysis and regression analysis. The study established that project design, material handling, procurement and reuse, recycle and reduce practices had a positive and significant effects on the performance of housing and water projects. The study concludes that project design strengthens the owner’s control of the entire design process and minimizes the risks in finance by contracting with a single firm that is unconditionally committed to the success of the project. Procurement helps the organization maintain quality and consistency, effectively, drive compliance and manage risk. Materials handling ensures that the right quality and quantity of materials are appropriately selected, purchased, delivered and handled on site in a timely manner and at a reasonable cost. Reuse, recycle and reduce practices are vital part in any waste management strategy because they help reduce waste handling and disposal costs, by avoiding the cost of recycling, land filling and combustion. The study recommends that Waste prevention and reduction in the design phases, project design should focus on reuse and recycling, waste-efficient procurement, materials optimization, off-site construction; and deconstruction and flexibility. Prospective contractors should be required in their tenders to indicate the likely waste recovery targets and key performance indicators that can be achieved on the project given the stage of the design. Government should introduce specific legislation governing the handling and disposal of construction wastes and follow up with strict monitoring to ensure compliance. The most effective environmental solution may often be to reduce the generation of waste and the amount of waste created using waste prevention measures. Re-use materials to avoid waste being created and where further reduction is not practicable, products and materials can sometimes be re-used, either for the same or a different purpose. Recycle materials from site where materials cannot be re-used and value should be recovered from waste, through recycling, composting or energy recovery from waste.
CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

The construction industry is mostly concerned with unique projects which creates difficulties for effective management control (Aretoulis, Kalfakakou and Striagka, 2010). According to Collins and Baccarini (2011) the construction process may be considered the most complex undertaking in any industry. Indeed, construction is a product-oriented activity that has many dimensions. The business aspects of construction require the establishment of contractual relationships with a wide range of parties. Adeyinka, Jagboro, Ojo and Odediran (2013) highlight to the complexity of construction projects because they bring together professionals within the industry to form an organizational team. Therefore, professionals should continue to uphold good ethical conducts, for better project performance and delivery in the construction industry.

The construction industry is one in which significant amounts of waste are generated which have deleterious effects on the health and safety of persons as well as the environment. Lu and Yuan (2011) report waste levels of 15-25 percent common in the literature pertaining to construction industry’s contribution to industrial waste. Medineckiene, Turskis and Zavadskas (2010) observe that common waste generated by the construction sector include; solid waste such as concrete, brickwork, stone, metals (particularly steel), timber and glass. These wastes are generated in workshops where work is being prepared for construction sites, at construction sites and by the activities of the consumers of construction products.

The construction industry permeates most of the economic sectors as it transforms various resources into the constructed infrastructure necessary for socio-economic development. However, despite its relevance for society, it is acknowledged that construction activities impact the natural
environment (Fuertes et al. 2013). According to Li and Zhang (2013) construction waste has become an important issue, due to its increasing generation and to its potential adverse effects on the environment. In addition, although construction waste is mostly inert, lack of management practices focused on reuse, recycling and other recovery alternatives reduces landfill space and results in loss of natural resources.

1.1.1 Project Performance in Construction Industry

Crawford and Bryce (2013) observe that a project is only successful if it comes on schedule, on budget, it achieves the deliverables originally set for it and it is accepted and used by the clients for whom the project was intended. Evaluating project performance means is based on projects completed on time and within the allocated budget, making sure the project contributes to the global strategy of a company or achieving customer satisfaction. Large infrastructure projects suffer from significant under management of risk in practically all stages of the value chain and throughout the life cycle of a project as indicated by Chua et al. (2014).

According to Doloi (2011), estimating is the primary function of the construction industry; the accuracy of cost estimates starting from early phase of a project through the tender estimate can affect the success or failure of a construction project. Many failures of construction projects are as a result of cost escalations. The increasing complexity of infrastructure and the environment within which projects are constructed places greater demand on construction managers to deliver projects on time, within the planned budget and with high quality (Enshasi et al., 2009).

1.1.2 Construction Waste Management Practices

Cheung (2013) stated that construction waste can be defined as the by-product generated and removed from construction, renovation and demolition workplaces or sites of building and civil engineering structures. Formoso et al. (2014) argue that any inefficiency that results in the use of
equipment, materials, labour, or capital in larger quantities than those considered necessary in the production of a building. Waste can be generated by mistakes, working out of sequence, redundant activity and movement, delayed or premature inputs and products or services that do not meet customer needs.

Johnston and Mincks (2011) proposed an integrated construction waste management plan that includes: reduction, recycling, reuse, incinerating, composting and landfill. Recycling is transforming waste into new products and reincorporating them into the construction process. Reuse means salvaging construction waste for other uses. Source reduction would be the best and most efficient way in minimizing construction waste. Hill and Bowen (2012) acknowledge reduced materials use, maximized reuse and recycling of resources, and use of renewable resources in their list of sustainable construction principles.

According to Berry and McCarthy (2011) procurement systems deal with risk allocation between the contractor and the employer. In a lump-sum contract, the risk allocation is regarded as fairer and more balanced in the perspective of employers because the employer has a better control in terms of the performance of the contractor and change management along the project. The roles and responsibilities are well defined and differentiated for the professionals who work in the project under this procurement system, particularly for the design–and-construction processes.

The construction industry is ranked first in European Union statistics for waste production and second in Sweden after mining and quarrying (Eurostat, 2016). Waste is produced by demolition, which is frequent in refurbishment projects; it is produced also from poor materials handling practices, design changes and inaccurate documents (Fadiya et al., 2014). Hao et al (2013) pointed out that waste management in construction activities should start from the design and the
procurement phases and, then, extend to onsite technologies and plans. Project designers should spend some time on considering how to reduce waste generation through reasonable design schemes, use of secondary materials, as well as, standardization of construction materials, dimensional coordination and application of modern methods of construction.

1.1.3 Construction Industry in Kenya

The construction sector in Kenya is very important for the Kenyan economy because it contributes close to 5 per cent of the country’s Gross Domestic Product (GDP) and employing more than one million people. According to report by Kenya National Bureau of Statistics (KNBS), the economy of Kenya grew by 4.9 per cent in the first quarter of 2011 due to the improved productivity in the construction industry. This can be attributed to higher public investment in infrastructure by the Government of Kenya (African Economic Outlook, 2012).

Kenya has engaged in deliberate effort to improve the construction sector since attaining her independence in 1963. In 1967, through an Act of Parliament, the Kenyan government set up a National Construction Corporation (NCC) to train African contractors in construction business management. The main function of NCC was to “promote, assist, and develop the construction industry” (Republic of Kenya, NCC Act 1972). Unfortunately, despite the best of efforts, NCC collapsed in 1988. The issues the industry was facing had only gotten bigger and more dynamic with changing times. Intense lobbying on the part of stakeholders in the industry finally led to the enactment of the National Construction Authority Act in 2011. The Act was assented to on 2nd December 2011 and operationalized on 8th June 2012. The National Construction Authority Regulations, which operationalize the Act, were passed on June 6th, 2014.
Currently, the government’s policy guidelines for various sectors in the economy are contained in the development plans published by the Ministry of Economic Planning every five years. The construction industry in Kenya is expected to see tremendous growth as a result of government spending on major infrastructure projects around the country.

1.2 Statement of the Problem

Construction industry in Kenya is one of major industry contributing significantly to the socio-economic development growth. Olawale and Sun (2010) indicate that most construction projects especially in Kenya are exposed to extreme cost escalation menace to the extent that it calls not only for extra funding but also specialized expertise hence leading to technical and project managerial conflicts between project’s parties. Although the government of Kenya sets aside huge sums of money to be spent in construction sector, the industry is facing a lot of challenges such as the expenditure exceeding the budget, delay to complete the project in time, the building defects and over-reliance on foreign workers.

Construction Waste Management is an aspect of sustainable development which is fuelled by the growing concern for the effect of man’s activities on the environment. The increase of construction activities due to development in developing countries increases the generation of construction waste. Effective waste management services can save your business money and benefit the environment at the same time. However, the Nairobi City County faces many challenges to manage construction waste disposal. These include insufficiently stringent legislation, poor enforcement, inadequate facilities and collection network, low public awareness and lack of capacity and negligent behaviour of local contractors due to lack of proper construction waste control and monitoring by the Nairobi City County.
A study carried out by Ya’cob, Zawawi, Isa and Othman (2013) examined factors that affect sustainable construction waste management efforts at site and found that lack of law enforcement from the Government led to the contractor not following the standard. However, the study used purposive sampling method. Osman, Nawi and Osman (2016) carried out a study on the effectiveness of construction waste management and its relationship with project performance and established that some of industry stakeholders do not realize that proper waste management will increase the project performance. However, the study used qualitative data. Trigunarsyah, Sofyan and Hendi (2016) study examined the housekeeping management as a strategy to minimize construction waste in high rise building projects and found that on-site activities on construction waste minimization can be integrated into the house-keeping management of the project site. However, the study used cross-sectional research design. Therefore, this study sought to investigate on the influence of construction waste management practices on the performance of housing and water projects.

1.3 Objectives of the Study

1.3.1 General Objectives

The general objective of this study was to investigate the influence of construction waste management practices on the performance of housing and water projects in Nairobi City County, Kenya.

1.3.2 Specific Objectives

i. To establish the influence of project design on the performance of housing and water projects in Nairobi City County, Kenya

ii. To identify the influence of procurement on the performance of housing and water projects in Nairobi City County, Kenya
iii. To examine the influence of material handling on the performance of housing and water projects in Nairobi City County, Kenya

iv. To investigate the influence of re-use, recycle and reduce practices on the performance of housing and water projects in Nairobi City County, Kenya

1.4 Research Questions

i. What is the influence of project design on the performance of housing and water projects in Nairobi City County, Kenya?

ii. What is the influence of procurement on the performance of housing and water projects in Nairobi City County, Kenya?

iii. What is the influence of material handling on the performance of housing and water projects in Nairobi City County, Kenya?

iv. How do re-use, recycle and reduce practices influence the performance of housing and water projects in Nairobi City County, Kenya?

1.5 Significance of the Study

The study would bring insight to the project managers and project team members in the construction industry in Kenya as they would be able to know the challenges and strategies that can be applied to achieve efficiency and effectiveness waste management in construction projects and ways of overcoming the risks involved. The study would enable policy makers in Nairobi City County, other counties and the national government in obtaining knowledge in proper ways in managing waste in the construction industry and therefore obtain guidance from the findings of this study in designing appropriate policies that favours the industry. The study would also add to the body of knowledge on proper management practices of construction material waste in the construction industry and provoke research in this area by creating a gap.
1.6 Scope of the Study
This study focused on housing and water projects in Nairobi City County, Kenya. The study focused how project design, procurement, material handling and re-use, recycle and reduce practices on performance of completed housing and water projects for the last 5 years (2013 – 2017). Project managers and project team members working in the county construction projects were involved in the study.

1.7 Limitations of Study
The study was limited by fear of respondents to disclose relevant information for the study. However, the researcher overcame this by assuring the respondents of strict confidentiality of any information disclosed and explaining the purpose of the study. Also, the study was conducted using predetermined questionnaires which could limit the respondents from expressing their views freely and widely. To overcome this, the researcher designed questionnaire with both open and closed ended questions.

1.8 Organization of the Study
This study was organized in five chapters. Chapter one constitutes the background of the study, statement of the problem, objectives, significance, scope, limitations and organization of the study. Chapter two comprises of the theoretical literature review, empirical literature review, summary of literature review and research gaps and conceptual framework. Chapter three encompasses the methodology which presents the research design, target population, sampling design, research instrument, data collection procedure, data analysis and ethical considerations. Chapter four constitutes the research findings and discussion which presents the response rate, background information, descriptive statistics, inferential statistics and analysis of qualitative data. Chapter
five presents the summary, conclusion, recommendations for policy and practice, and recommendations for further study.
CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction
This chapter deals with theoretical literature review, empirical literature review, summary of reviewed literature and research gaps and conceptual framework.

2.2 Theoretical Literature Review
2.2.1 Theory of Constraints
Eliyahu developed the theory of constraints in the early 1980s to help organizations decide what to change, identify a desirable new condition and how to trigger the change. He recommended first identifying the main factors affecting budget estimates in an organisation. He then suggested that the managers figure out how to handle the constraints or barrier to success within prescribed budget. By focusing on fixing the main problem, overall performance could be improved (Eliyahu, 2004). Additionally, Baloi and Price (2003) observed that most organizations fail to examine their operations as a whole when developing cost estimates. By focusing only on short-term goals, long-term success becomes jeopardized so he suggested establishing a long-term view.

Theory of Constraints which opines that an organization facing challenges in cost management, poor performance and chronic conflicts is as a result of poor management practices and lack of necessary intervention. According to this theory, all systems operate in an environment of cause and effect. One event causes another to happen thus prompting for factors analysis as a measure. Adherence to cost estimates is either a constraint or has the potential to become a constraint. This cause-and-effect relationship can be very complex, especially in complex systems such as those of construction projects. Capturing the essence of cause and effect within the system and
identifying factors that emulate these relationships are the keys to system performance and excellent adherence to cost estimates.

This theory is relevant to the study as it shows it is a systematic and iterative approach to management that emphasizes adapting business practices in order to best cope with limitations, or constraints, that stand in the way of key objectives. The goal of TOC is to maximize the efficiency of a process selectively at the most critical points and thereby maximize profitability, quality, or other corporate objectives. Therefore, construction companies in Kenya should consider key areas within the organization for competitive improvement, key technologies and techniques, improvement and investment opportunities related to the management of construction waste materials.

2.2.2 Transaction Cost Analysis (TCA) Theory

This study was guided by Transaction Cost Analysis (TCA) advocated by Williamson (1981) who argues that Transaction Cost Analysis (TCA) theory ensures that costs across the supply chain are kept at a minimal. Transaction cost approach has been widely used in different areas, especially in economics and organizational studies. In the early 1970s, the mathematical economist, Williamson, incorporated TCA into the general equilibrium model and set up his transaction cost economics in the new theory of the firm.

Halldorsson (2007) suggests that organizations can reduce their transaction costs by vertical integration and increasing the level of trust at the same time. This kind of integration can reduces the costs of inventory management while increasing the service level of both internal and external customers while releasing capital to be used in other areas of the organization. Organizational supply chain can however reduce transaction not only through vertical integration and increasing
the level of trust among supply chain participants, but also through horizontal integration and economy of scale gained from the aggregation of supply and/or demand.

This theory is relevant to the study as it shows that organizations should minimize their cost of transaction so as to increase their revenue generation. These costs should be obtained from the market rather than having it provided from within the firm. Therefore, organizational managers must weigh the internal transaction costs and against external transaction costs during material handling practice before the company decides whether or not to keep some activities in-house.

2.2.3 **Balance Theory of Recycling**

This study was guided by balance theory of recycling advocated by Wong and Yip (2002). The Balance Theory rouses construction workers to adopt the idea of reduction of wastes. They are educated to clean their working places constantly and collect all construction wastes they generated into separate collection spots within the construction site. According to Alexander (2008), the site management personnel is required to establish site facilities and set up conditions in employment contracts and subcontracts for workers and subcontractors to follow. The culture of separating wastes at sources must be established and widely adopted so that Balance Theory could be realised.

Balance Theory of recycling advocates the amount of wastes generated from a construction project and sent for recycling process must be equivalent (or proportional) to the amount of the recycled Construction and Demolition (C&D) products imported and used as construction materials for that project (Poon et al, 2011). Zero C&D wastes sent to landfill may be too idealistic, however, minimisation of C&D wastes could be realised if Balance Theory is enforced.

The theory advocates that the amount of wastes generated from a construction project and sent for recycling process must be equivalent (or proportional) to the amount of the recycled Construction
and Demolition (C&D) products imported and used as construction materials for that project. Though the construction industry produces quite significant amount of C&D wastes, they can be recycled, reduced and re-used into construction projects and benefit the community as a whole.

2.2.4 Resource Based View Theory

This study was guided by Resource Based View theory as proposed by Barney (1991). Barney (1991) states that a firm is a collection of physical capital resources, human capital resources and organizational resources. The core premise of the resource-based view is that organizational resources and capabilities can vary significantly across firms, and that these differences can be stable. The theory focuses on the idea of costly-to-copy attributes of the firm as sources of business returns and the means to achieve superior performance and competitive advantage.

Chandler (1990) indicates that organizational capabilities emanates from lower management, middle and top management and that a firm can gain competitive advantage when its resources and capabilities are used properly. He further states that if these organization capabilities were carefully synchronized and assimilated it could achieve the economies of scale and scope needed to compete in national and international markets.

Barney (1991) states that, “sustainable competitive advantage is derived from resources that are valuable, rare, imperfectly imitable (due to path-dependence, causal ambiguity, and social complexity), and no substitutable”. A resource-based view of the firm accepts that attributes related to past experiences, organizational culture and competences are critical for the success of the firm.

This theory is relevant to the study because it shows that construction companies manage their waste on the basis of their resources and capabilities. A firm resource must, in addition, be
valuable, rare, and imperfectly imitable and substitutable in order to be source of effective management of construction wastes. Resources may increase the company’s capacity for proper management of wastes and, thus, contribute to project performance by helping the firm to appropriate the value. Furthermore, resources may be used to erect entry barriers and so increase performance at the industry level.

2.3 Empirical Literature Review

2.3.1 Project Design and Project Performance

Love (2010) in their study noted that a mistake made in design could result in errors in procurement and construction, thereby leading to rework and subsequent waste generation. It is, therefore, important that construction project lifecycle is evaluated from system perspective in order to develop causal loops and feedback system of such interdependent processes. This could help in understanding impacts of one activity on the others, as well as on the overall project outcome.

Yu et al. (2010) through their study on design build projects in Hong Kong reveal that existing systems for project development have limitations. Lack of impartial agents and improper timing for raising requirements by key stakeholders are problems with existing systems. Aftab, Rahman, Abdullah and Azis (2010) stated that fluctuation in price of material, cash flow and financial difficulties faced by contractors, shortage of site workers, lack of communication between parties, incorrect planning and scheduling by contractors are most severe factors while frequent design changes and owner interference are least affecting factors on construction cost performance.

A study carried by Osmani (2012) noted that about 33 per cent of construction waste occurs because of design-related factors. This implies that attempts to tackle waste at design stage would result in substantial reduction in waste. On the other hand, a study carried out by Osmani (2012) found that
waste management legislation has been practically non-existing with respect to design stage, despite the understanding that some causes of waste are design related. As the legislation continuously drives waste management strategy, it is expected that minimum benchmark is set for projects, while the waste preventive standard is also set for design stage.

Kibuchi and Muchungu (2012) discovered that despite the high quality of training of consultants in the building industry in Kenya and regulation of the industry in major urban areas, construction projects do not always meet their goals. This is manifested by myriad projects that have cost overrun, delayed completion period and poor quality resulting to collapsed buildings in various parts of the country, high maintenance costs, dissatisfied clients and even buildings which are not functional.

In a survey of 139 projects, Lopez and Love (2012) estimated direct and indirect design error costs at 6.85 percent and 7.36 percent of project cost respectively. Errors and omissions in designs lead to claims and conflict in projects. Design quality control and assurance, effective communication, and post-design inspection are management techniques that lead project to engineering success.

Osmani (2013) in their study found that the best approach for tackling waste is through dedicated efforts at the design stage of building delivery process. The study concluded that there is still low acceptance and use of recycled products within the construction industry due to a low commitment from designers who drive materials selection and sustainability practices within the industry. Based on these findings, and in order to understand the procedural approach to designing out waste through dedicated design effort, this study focuses ways to seek to aggregate the design factors capable of influencing waste in construction projects.
2.3.2 Procurement Practice and Project Performance

Love et al (2008), through their research into public sector procurement method selection in Queensland and Western Australia, espoused the notion that “the continual use of traditional lump sum may stifle technological innovation, particularly the design and constructability of public sector buildings.” Indeed, since 2000 the relationship between build-ability and procurement method has been widely discussed, with most authors in agreement that fully integrated procurement methods such as design and build and project management are most appropriate for clients placing a high priority on the build-ability of their project.

Sabiti, Basheka and Muhumuza (2011) in their study conducted in Uganda on developing public procurement performance measurement systems in developing countries: the Uganda experience, the authors note how proper planning may influence procurement performance. The key to accountability is the capacity to select the best contractors within the public sector. The internal contractor selection process of government, procurement and personnel have long received sustained attention as the centerpiece of reforms to promote accountability. The study found that problems of accountability arise when government ignore or transgress social ethics and constitutional and legal provisions in conducting public affairs, administrative systems are fragmented, tasks to be performed are so many.

A study carried out by Oluka (2013) on the challenges of procurement, posits that restricted tendering is a procurement method that limits the request for tenders to a select number of contractors. According to the PPDA Regulation 2014, the restricted procurement method is a two-stage process. The first stage the employer advertises his project and invites contractors to express interest to be placed on a selected list of contractors who will be invited to bid for the project. In creating a nexus between the earlier study and the proposed study, it is imperative that when
contractors applying should be given a list of information, and information got about them in order to pre-qualify. Stage two the shortlisted contractors who meet the selection criteria should be invited to submit a more detailed tender submission.

A study carried out by Mbalangu (2013) on compliance monitoring and procurement performance carried out in Uganda notes that supplier contractor monitoring has slowly become an important component for effective supplier relationship management that is directly linked to securing the supply of key commodities needed for sustaining business. On the other hand, Kansiime (2014) in his study on the impact of public procurement reforms on service delivery in Uganda notes that monitoring of this formalized relationship allows an organisation a degree of control over the deliverables and performance requirements.

Schmitz and Platts (2014) in their study conducted in Ghana did investigate the procurement reforms in Ghana. They assert that the main aim of contracting is to ensure that goods or services are delivered on time, at the agreed cost and at the specified requirements. It means developing effective working relationships with your suppliers, ensuring effective service delivery, maximising value for money and providing consistent quality for stakeholders and end users. The study also established that the primary goal for contractor monitoring within any company is to ensure that commitments and obligations to customers and suppliers are clearly visible to the relevant people in the organization and that they are executed upon.

2.3.3 Material Handling and Project Performance

Previous studies have identified that building materials often require a large storage capacity which is rarely available on site (Agapiou et al. 2009; Bell & Stukhart, 2011). However, Stukhart (1995) suggested that there are a few considerations to take in the planning of the storage space such as
timing of the initial buy, and historical information and experience. Materials management on site should seek to reduce loss of profit due to theft, damage and wastage, as well as running out of stock. It is also important to ensure that the right quality and quantity of materials and installed equipment are appropriately specified in a timely manner, are obtained at a reasonable cost, and are available when needed.

According to Chan (2012) material handling equipment selection is an important function as it can enhance the production process, provide effective utilization of manpower, increase production and improve system flexibility. Material storage on site requires close attention in order to avoid waste, loss and any damage of materials which would affect the operation of the construction project. Problems always arise during materials supply because of improper storage and protection facilities. The importance of appropriate handling of materials is highlighted by the fact that they are expensive and engage critical decisions. Due to the frequency of handling materials there are quality considerations when designing a materials handling system.

A study carried out by Ogunlana (2014) found that the main reasons for project delays on housing projects in Thailand were incomplete drawings, material management problems, deficiencies in organisation, shortages of construction materials, and inefficiencies in site workers. Dey (2014) also found that delays in materials supply was a major cause of time overrun of construction projects in India. Thus, it would seem that materials delays are a major cause of delays in projects. Lwanga (2014) in his study focused on the investigation on re-using construction waste for sustainable development with particular attention to concrete waste. Much of the research has in the past concentrated on household waste with little attention to other sectors such as construction. A study by Edema et al. (2011) revealed that a study on the Copperbelt province of Zambia showed
that lack of environmentally friendly, sustainable and affordable waste management had led to the wide spread open dumping and open burning of solid waste. In another study that included Zambia and reported in the Africa Review Report on waste management (2013), it was concluded that poor waste management practices in particular the widespread dumping of wastes in water bodies and uncontrolled dump sites aggravates the problems of generally low sanitation levels across the African continent.

A study carried out by Solanke (2015) found that scheduling delays occurred in 70 percent, 40 percent and 50 percent of government contracted construction projects in the United Kingdom, India, and United Arab Emirates (UAE) respectively due to improper material management. Currently all over the globe the main reason in cost variance and problematic management of material are due to overstocked construction materials because of improper planning, damaged construction materials due to logistics, handling or in application, loss of construction materials because of improper supervision, waiting of the construction materials to arrive in location due to improper tracking systems.

2.3.4 Reuse, Reduce, Recycle Practices and Project Performance

According to Hore, Kehoe, McMillan and Penton (2010), for every 100 houses built there is enough waste material to build another 10 houses. Similarly Akinpelu (2013) study found that on most capital projects resources from which wastes are generated account for more than 60per cent of their production costs. As concerns grow over the amount of waste generated in the construction industry, recycling has been identified as one of the most feasible way to overcome construction waste. In most cases, up to 90 percent of the waste generated is recyclable.
In a study conducted on Turkish construction sites, Polat and Ballard (2010) established that minimisation is the best and most effective method of reducing the generation of waste and eliminating many of the waste generation problems. Greenwood et al. (2012) study found that the top priority in minimising waste is to avoid waste through designing out or reducing waste at the source and proposed three key project stages where waste minimisation initiative should be introduced; contractual, design and site execution stages. The study recommended that construction firms must develop or adopt effective waste minimisation strategies in order to solve the problem of material wastage on construction projects.

A study carried out by Mason (2010) found that it is estimated that in the UK, a recycling rate of around 45 per cent has been achieved for construction and demolition waste; by contrast the Netherlands, Belgium and Denmark, have achieved ninety percent, eighty seven percent and eighty one percent, respectively. The study recommended that the success of any recycling initiative depends upon a market for Construction and Demolition (CD) Waste being available. In turn, this depends upon the next user’s confidence in the material with respect to its quality, sufficiency, price, location and timely availability.

Akinkurolere and Franklin (2015) carried out an Investigation into Waste Management on Construction Sites in South Western Nigeria. The study focused on the dangers posed by material waste in the construction industry, ways of minimizing construction waste, ways of keeping proper site records for accountability sake and recommend effective waste management measures. The study adopted questionnaires to collect data from construction professionals, and employed tables and statistical indices for the data analysis. The study revealed that material wastage increase the cost of construction project and reduce contractor’s profit and attributed construction was to poor
management and lack of effective waste management awareness. The study recommended that construction waste management should be recycled and reused.

2.4 Summary of Literature Reviewed and Research Gaps

Table 2.1: Summary of Literature Reviewed and Research Gaps

<table>
<thead>
<tr>
<th>Author</th>
<th>Focus of the Study</th>
<th>Findings</th>
<th>Knowledge gap</th>
<th>Focus of the current study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lu &amp; Yuan (2010)</td>
<td>Exploring critical success factors for waste management in construction projects of China</td>
<td>The enormous amount of construction activity in China associated with its rapid economic development has produced a large amount of construction and demolition (C&amp;D) waste over the past three decades</td>
<td>The study did not focus on how procurement practices influence construction projects</td>
<td>Procurement practice on project performance</td>
</tr>
<tr>
<td>Shen and Tam (2012)</td>
<td>Implementation of environmental management in the Hong Kong construction industry.</td>
<td>Implementation of environmental management involves allocating a variety of resources for practicing various environmental management methods waste recycling and reusing</td>
<td>The study did not look at the influence project design stage on the performance of construction projects</td>
<td>Project design on project performance</td>
</tr>
<tr>
<td>Cherutch (2013).</td>
<td>E-waste management in Kenya: A case study of mobile phone waste in Nairobi</td>
<td>mobile phone GPN in Kenya includes post consumption activities where mobile phone E-waste are recycled and exported.</td>
<td>The study did not reuse, reduce and recycling practices on E-waste management of mobile phones</td>
<td>Re-use, recycle and reduce on project performance</td>
</tr>
<tr>
<td>Ng’ang’a (2015).</td>
<td>Contributions of Green Construction Practices on the Growth of the Construction Industry in Kenya</td>
<td>The construction of a green building can be part of an overall plan for sustainable corporate development</td>
<td>The study did not address ways of achieving energy and resource efficiency on construction projects.</td>
<td>Material handling practice on project performance</td>
</tr>
</tbody>
</table>
2.5 Conceptual Framework

Figure 2.1 shows a conceptual framework which depicts the relationship between the independent variable and the dependent variable; it was based on four independent variables and one dependent variable. The independent variables are project design, procurement, material handling, reuse, reduce, recycle practices and the dependent variable is the performance of construction projects.

**Independent Variables**

**Project Design**
- Specification
- Problem identification
- Objective setting

**Procurement**
- Item specification
- Ordering process
- Quantity survey

**Material Handling**
- Storage
- Transportation
- Theft

**Reuse, Reduce, Recycle practices**
- Reinvention
- Treatment
- Dispose

**Dependent Variable**

**Project Performance**
- Quality
- Timeliness
- Cost effective
- Efficiency

Source: Researcher (2017)

Figure 2.1: Conceptual Framework
CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Introduction
This chapter comprises of the Research Design, Target Population, Sampling Procedures and Sample Size, Research Instrument, Pilot Study, Data Collection Techniques, Data Analysis and Ethical Consideration.

3.2 Research Design
This study was carried out through a descriptive survey research design and explanatory research design. Descriptive survey research design is a method of collecting information by interviewing or administering a questionnaire to a sample of individuals (Saunders et al, 2009). Descriptive survey research design was chosen because it enabled the researcher to generalise the findings to a larger population and it was more precise and accurate since it involves description of events in a carefully planned way.

3.3 Target Population
The target population under study comprised of 95 housing and waster construction projects in Nairobi County (Nairobi County report, 2017). The study involved 3 permanent staff from each construction project as they were able to provide informative details concerning the research. Therefore, the total respondents were 285. This is shown in Table 3.1.

Table 3.1: Target population

<table>
<thead>
<tr>
<th>Construction Projects</th>
<th>Number of Projects</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Projects</td>
<td>39</td>
<td>117</td>
</tr>
<tr>
<td>Housing Projects</td>
<td>56</td>
<td>168</td>
</tr>
<tr>
<td>Total</td>
<td>95</td>
<td>285</td>
</tr>
</tbody>
</table>

3.4 Sampling Design and Sampling Size

As observed by Gay (2002), a sample is selected which can be representative of the total population because of various constraints that may face the researcher in accessing the whole population. On the other hand, Mugenda and Mugenda, (2003), observe that in a situation where the study population there is no need to sample otherwise the total population should be studied. Therefore, census of 285 respondents was carried out.

3.5 Data Collection Instruments

This study used questionnaire as a data collection tool to all the respondents. Orodho (2005) defines a questionnaire as an instrument used to gather data, which allows a measurement for or against a particular viewpoint. The author emphasizes that a questionnaire has the ability to collect a large amount of information in a reasonably quick space of time. The instrument was chosen because the targeted population was literate which minimized the interpretation of the questions for their understanding to capture reliable information. The questionnaires were divided into different sections covering the objectives of the study. Likert scale was used in questions which tested on the degree of the respondents’ agreement with particular variables of the study.

3.6 Pilot Study

According to Kothari (2004), a pilot test is necessary for testing the reliability of data collection instruments. The aim of the pilot study was to test the reliability of the questionnaires. Pilot study was conducted to detect weakness in design and instrumentation and to provide proxy data for selection of a sample. The pilot study was conducted to 10 respondents who did not participate in the actual study.

3.6.1 Validity of the Instruments
Validity is the degree to which the research instruments was appropriately and accurately measure what they are supposed to measure (Orodho, 2005). Content validity was done to ascertain clarity and simplicity. The researcher used clear wording of the questions by using terms that are likely to be familiar to, and understood by the respondents. The researcher engaged his supervisor as the research expert to ascertain whether the content of the research instrument were up to standard.

3.6.2 Reliability of the Instruments

Cronbach’s alpha test was used to measure the internal consistency of the research instrument by obtaining a correlation coefficient. It also allowed measurement of reliability of every statement used to measure an objective under different categories and estimates the extent to which scores vary in different variables attributed chance or random errors (Reid, 2006). The author further shows that for the instruments to be reliable the correlation coefficient must be greater than 0.7. This study obtained a correlation coefficient of 0.744 which showed that the instruments are reliable for data collection as recommended by Mugenda and Mugenda (2003). This is shown in Table 3.2.

<table>
<thead>
<tr>
<th>Variable</th>
<th>No. of Items</th>
<th>Cronbach’s Alpha</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Design</td>
<td>6</td>
<td>0.834</td>
<td>Reliable</td>
</tr>
<tr>
<td>Procurement</td>
<td>6</td>
<td>0.608</td>
<td>Reliable</td>
</tr>
<tr>
<td>Material Handling</td>
<td>6</td>
<td>0.741</td>
<td>Reliable</td>
</tr>
<tr>
<td>Reuse, Reduce and Recycle Practices</td>
<td>6</td>
<td>0.774</td>
<td>Reliable</td>
</tr>
<tr>
<td>Overall</td>
<td>32</td>
<td>0.744</td>
<td>Reliable</td>
</tr>
</tbody>
</table>

Source: Survey Data (2018)

3.7 Data Collection Procedure
Top level management were contacted to affirm the intention for carrying out the study on the organization and to clarify the significant of the study and the commitment required from the management. Research assistants were employed to administer the questionnaires which were dropped to each respondent and picked later after two weeks. The researcher made a follow up through phone calls and in addition, visited the respondents before the stated period to remind them on the importance of responding to the questionnaire.

3.8 Data Analysis and Presentation

This study obtained both quantitative data and qualitative data. Quantitative data was analyzed using descriptive statistics such as mean and standard deviation and presented in tables, charts and graphs. These were generated using Statistical Package for Social Sciences (SPSS) version 17.0. Content analysis technique was used to analyze qualitative data collected using interview schedules.

The study used Analysis of Variance (ANOVA) to test the level of significant of the variables on the dependent variable at 95per cent confidence level. In addition, the study conducted a multiple regression analysis to test the relationship between independent variables and dependent variable. The regression equation was:

\[ Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon \]

Whereby

- \( Y \) = Performance of Construction Projects
- \( X_1 \) = Project Design
- \( X_2 \) = Procurement
- \( X_3 \) = Material Handling
- \( X_4 \) = Reuse, Reduce and Recycle Practices
- \( \beta_1, \beta_2, \beta_3 \) are coefficients of determination
is the error term.

3.9 Ethical Consideration

In this study the researcher acquired a permit from the National Commission for Science, Technology and Innovation (NACOSTI) and an introduction letter from the University before proceeding to the study area. Participants were given adequate information on the aims of the research, the procedure that would be followed, the credibility of the researcher and the way in which the results were used. This enabled participants to make an informed decision on whether they want to participate in the study or not. Participant confidentialities were not compromised as their names were not indicated in the questionnaire.
CHAPTER FOUR

RESEARCH FINDINGS AND DISCUSSIONS

4.1 Introduction

The chapter discusses major findings as per the research objectives. Quantitative approach was used to analyze data. Descriptive statistics and inferential statistics were presented in terms of tables, figures, graphs and charts.

4.2 Response Rate

Out of 285 questionnaires that were distributed to the respondents, 212 were successfully filled and taken back. This represented a response rate of 74.4 per cent as shown in Table 4.1. Nachmias (2009) observed that a response rate exceeding 50 per cent is sufficient for analysis and thus, 74.4 per cent return rate, was considered to be very good. This commendable response rate was attributed to the data collection procedure, where the researcher engaged researcher assistants to administer questionnaires.

Table 4.1: Response Rate

<table>
<thead>
<tr>
<th>Category</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respondent</td>
<td>212</td>
<td>74.4</td>
</tr>
<tr>
<td>Not Respondent</td>
<td>73</td>
<td>25.6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>285</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

Source: Survey Data (2018)

4.3 Background Information

The study sought to establish the background information of the respondents in terms of their gender, age, education level and work experience.
4.3.1 Distribution of Respondents by Gender

The study sought to determine the gender of the respondents; the findings are presented in Figure 4.1.

**Figure 4.1: Respondents’ Gender**

Source: Survey Data (2018)

Majority of those who participated in the study were male respondents who accounted for 54.25 per cent while female constituted 45.75 per cent. This means that there could be gender disparity in some projects.

4.3.2 Distribution of Respondents by Age

The study sought to determine the gender of the respondents; the findings are presented in Figure 4.1.

**Table 4.2: Respondents’ Age**

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 25 years</td>
<td>11</td>
<td>5.2</td>
<td>5.2</td>
</tr>
<tr>
<td>25 - 34 years</td>
<td>76</td>
<td>35.8</td>
<td>41.0</td>
</tr>
<tr>
<td>35 - 44 years</td>
<td>74</td>
<td>34.9</td>
<td>75.9</td>
</tr>
<tr>
<td>45 years and above</td>
<td>51</td>
<td>24.1</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>212</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

Source: Survey Data (2018)
According to the findings, majority of the respondents were between the ages of 25 to 34 years as represented by 35.8 per cent. 34.9 per cent of the respondents were between 35 to 44 years, 24.1 per cent aged 45 years and above and 5.2 per cent aged less than 25 years old. The cumulative frequency of 75.9 per cent show that majority of the respondents were aged 35 years and above. This shows that the study participants were obtained from different age gaps.

4.3.3 Respondents’ Level of Education

The study sought to determine the respondents’ level of education; the findings are presented in Figure 4.2.

**Figure 4.2: Respondents’ Level of Education**

According to the results as shown in Figure 4.2, majority of the respondents had attained a Bachelors degree level of education as represented by 44.81 per cent, 27.36 per cent had Master’s degree, 17.92 per cent Post graduate diploma and 9.91 per cent diploma certificate. According to the findings it can be deduced that waste management requires educated individuals with specific skill and regular training.

**Source: Survey Data (2018)**

According to the results as shown in Figure 4.2, majority of the respondents had attained a Bachelors degree level of education as represented by 44.81 per cent, 27.36 per cent had Master’s degree, 17.92 per cent Post graduate diploma and 9.91 per cent diploma certificate. According to the findings it can be deduced that waste management requires educated individuals with specific skill and regular training.
4.3.4 Respondents’ Work Experience

The study sought to determine the respondents’ years of experience; the findings are presented in Table 4.3.

**Table 4.3: Respondents’ Work Experience**

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid Less 5 years</td>
<td>31</td>
<td>14.6</td>
<td>14.6</td>
</tr>
<tr>
<td>5 - 9 years</td>
<td>58</td>
<td>27.4</td>
<td>42.0</td>
</tr>
<tr>
<td>10 - 15 years</td>
<td>73</td>
<td>34.4</td>
<td>76.4</td>
</tr>
<tr>
<td>Above 15 years</td>
<td>50</td>
<td>23.6</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>212</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

*Source: Survey Data (2018)*

According to the results as shown in Table 4.3, majority of the respondents had worked for a period of 10 to 15 years as represented by 34.4 per cent, 27.4 per cent between 5 to 9 years, 23.6 per cent for over 15 years and 14.6 per cent for less than 5 years. The cumulative frequency of 76.4 per cent indicated that majority of the respondents had worked for more than 10 years.

4.4 Descriptive Statistics

Descriptive statistics such as means and standard deviations were used to present that quantitative data with the use of Statistical Package for Social Sciences (SPSS) version 17.0. It was based on study variables which were project design, procurement, material handling, reuse, reduce and recycle practices and performance of construction projects.

4.4.1 Project Design

The study sought to establish the extent to which project design influence the performance of housing and water projects in Nairobi City County, Kenya. The findings are presented in Table 4.4.
Table 4.4: Project Design and Project Performance

<table>
<thead>
<tr>
<th>Aggregate Score</th>
<th>Mobile application to increase the level of accessibility their customers have to them</th>
<th>Mobile application enables tea companies to provide value to their customers</th>
<th>Mobile application enables tea companies to build a stronger brand</th>
<th>Mobile application enables tea companies to connect better with clients</th>
<th>Mobile application boosts the profits of tea companies</th>
</tr>
</thead>
<tbody>
<tr>
<td>N Valid</td>
<td>212</td>
<td>212</td>
<td>212</td>
<td>212</td>
<td>212</td>
</tr>
<tr>
<td>Missing</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Mean</td>
<td>4.11</td>
<td>3.78</td>
<td>3.22</td>
<td>3.11</td>
<td>3.47</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>.994</td>
<td>1.217</td>
<td>1.525</td>
<td>1.385</td>
<td>1.436</td>
</tr>
</tbody>
</table>

Source: Survey Data (2018)

From the findings, the respondents agreed that project design influences performance of housing and water projects in Nairobi City County, Kenya to a great extent as shown by aggregate score of 3.45 with significance variance of 1.349. Majority of the respondents strongly agreed on the statements that specifications are detailed and devoid of under/over ordering and waste management plan is prepared along with the design as expressed by a mean score of 4.11 and 3.78 respectively which varied significantly as indicated by the standard deviation of 0.994 and 1.217 respectively. These findings concur with the findings of Osmani (2012) who noted that about 33 per cent of construction waste occurs because of design-related factors. This implies that attempts to tackle waste at design stage would result in substantial reduction in waste.

The respondents also agreed on the statements that awareness of material quantity, quality and durability and knowledge and ability to design for standard materials supply influences
performance of housing and water projects to great extent as shown by mean of 3.47 and 3.22 respectively with a respective significance variance of 1.436 and 1.525. These findings are in line with the findings of Aftab et al (2010) who stated that fluctuation in price of material, cash flow and financial difficulties faced by contractors, shortage of site workers, lack of communication between parties, incorrect planning and scheduling by contractors are most severe factors while frequent design changes and owner interference are least affecting factors on construction cost performance.

The respondents also indicated that ability to coordinate dimensions of building elements and components and specify durable materials to avoid need for early replacement influences performance of housing and water projects to a moderate extent as represented by a mean of 3.11 and 3.02 respectively and a significance variance of 1.385 and 1.539. These findings contradicts with the findings of Osmani (2013) who established that the best approach for tackling waste is through dedicated efforts at the design stage of building delivery process. Love (2010) also noted that a mistake made in design could result in errors in procurement and construction, thereby leading to rework and subsequent waste generation.

4.4.2 Procurement and Project Performance

The study sought to establish the extent to which procurement influence the performance of housing and water projects in Nairobi City County, Kenya. The findings are presented in Table 4.5.
Table 4.5: Procurement and Project Performance

<table>
<thead>
<tr>
<th></th>
<th>Supplier flexibility in providing small quantities of materials</th>
<th>Procurement route that minimizes packaging</th>
<th>Ordering material with high content recycled material</th>
<th>Vendors that supply quality and recycled materials</th>
<th>Planning for good delivery schedule onsite</th>
<th>Reduced excess order to avoid breakage</th>
<th>Aggregate Score</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>N</strong></td>
<td>212</td>
<td>212</td>
<td>212</td>
<td>212</td>
<td>172</td>
<td>212</td>
<td></td>
</tr>
<tr>
<td><strong>Valid</strong></td>
<td>212</td>
<td>212</td>
<td>212</td>
<td>212</td>
<td>172</td>
<td>212</td>
<td></td>
</tr>
<tr>
<td><strong>Missing</strong></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td>3.23</td>
<td>3.20</td>
<td>3.38</td>
<td>2.42</td>
<td>3.17</td>
<td>2.93</td>
<td><strong>3.06</strong></td>
</tr>
<tr>
<td><strong>Std. Deviation</strong></td>
<td>1.547</td>
<td>1.632</td>
<td>1.647</td>
<td>1.390</td>
<td>1.243</td>
<td>1.241</td>
<td><strong>1.450</strong></td>
</tr>
</tbody>
</table>

**Source: Survey Data (2018)**

From the findings, the aggregate score of 3.06 shows that the respondents were neutral that procurement influences performance of housing and water projects in Nairobi City County, Kenya. This varied significantly as shown by a standard deviation of 1.450. Majority of the respondents agreed on the statements that ordering material with high content recycled material, supplier flexibility in providing small quantities of materials, procurement route that minimizes packaging and planning for good delivery schedule onsite influences performance of housing and water construction projects to a great extent as shown by mean score of 3.38, 3.23, 3.20 and 3.17 respectively. These varied significantly as indicated a standard deviation of 1.647, 1.547, 1.632 and 1.243 respectively. These findings agree with the findings of Schmitz and Platts (2014) who observe that the main aim of contracting is to ensure that goods or services are delivered on time, at the agreed cost and at the specified requirements. It means developing effective working relationships with your suppliers, ensuring effective service delivery, maximising value for money and providing consistent quality for stakeholders and end users.

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The study also established that reduced excess order to avoid breakage and vendors that supply quality and recycled materials influences performance of housing and water construction projects to a moderate extent as shown by a mean of 2.93 and 2.42 respectively with a variance of 1.241 and 1.390 respectively. These findings contradicts with the findings of Sabiti, Basheka and Muhumuza (2011) who observe that the key to accountability is the capacity to select the best contractors within the public sector. The internal contractor selection process of government, procurement and personnel have long received sustained attention as the centerpiece of reforms to promote accountability.

4.4.3 Material Handling

The study sought to establish the extent to which material handling influence the performance of housing and water projects in Nairobi City County, Kenya. The findings are presented in Table 4.6.

**Table 4.6: Material Handling and Project Performance**

<table>
<thead>
<tr>
<th></th>
<th>Use of safe materials storage facilities</th>
<th>Prevention of double handling of materials</th>
<th>Providing bins for collecting wastes for each of the sub-contractor</th>
<th>Adequate site access for material delivery and movement</th>
<th>Waste auditing to monitor and record environmental performance onsite</th>
<th>Dedicated space for sorting of waste</th>
<th>Aggregate Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>N Valid Missing</td>
<td>212</td>
<td>212</td>
<td>212</td>
<td>212</td>
<td>212</td>
<td>212</td>
<td>212</td>
</tr>
<tr>
<td>Mean</td>
<td>3.57</td>
<td>2.52</td>
<td>2.26</td>
<td>2.21</td>
<td>3.44</td>
<td>2.88</td>
<td>2.81</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>.820</td>
<td>1.468</td>
<td>.679</td>
<td>1.105</td>
<td>1.381</td>
<td>1.382</td>
<td>1.139</td>
</tr>
</tbody>
</table>

*Source: Survey Data (2018)*
From the findings, the aggregate score of 2.81 indicates that the respondents were neutral that material handling affects performance of housing and water projects in Nairobi City County, Kenya with a significance variance of 1.139. Majority of the respondents agreed on the statements that use of safe materials storage facilities and waste auditing to monitor and record environmental performance onsite as shown by mean score of 3.57 and 3.44 respectively with a respective variance of 0.820 and 1.381. These findings are in line with the findings of Ogunlana (2014) who found that the main reasons for project delays on housing projects in Thailand were incomplete drawings, material management problems, deficiencies in organisation, shortages of construction materials, and inefficiencies in site workers.

The study established that dedicated space for sorting of waste, prevention of double handling of materials, providing bins for collecting wastes for each of the sub-contractor and adequate site access for material delivery and movement moderately influences the performance of housing and water construction projects as shown by mean score of 2.88, 2.52, 2.26 and 2.21 respectively with respective mean score of 1.382, 1.468, 0.679 and 1.105. The findings contradicts with the findings of Edema et al. (2011) who revealed that a study on the Copperbelt province of Zambia showed that lack of environmentally friendly, sustainable and affordable waste management had led to the wide spread open dumping and open burning of solid waste.

4.4.4 Reuse, Recycle and Reduce Practices

The study sought to establish the extent to which re-use, recycle and reduce practices influence the performance of housing and water projects in Nairobi City County, Kenya. The findings are presented in Table 4.7.
Table 4.7: Reuse, Recycle and Reduce Practices on Project Performance

<table>
<thead>
<tr>
<th>Database management system improves data sharing in Tea companies</th>
<th>Database management system improves data sharing in Tea companies</th>
<th>Database management system improves data sharing in Tea companies</th>
<th>Database management system improves data sharing in Tea companies</th>
<th>Database management system improves data sharing in Tea companies</th>
<th>Aggregate Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>212</td>
<td>212</td>
<td>212</td>
<td>210</td>
<td>210</td>
</tr>
<tr>
<td>Missing</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Mean</td>
<td>3.65</td>
<td>3.60</td>
<td>3.83</td>
<td>3.84</td>
<td>3.69</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>1.236</td>
<td>1.507</td>
<td>1.420</td>
<td>1.468</td>
<td>1.410</td>
</tr>
</tbody>
</table>

**Source:** Survey Data (2018)

From the findings, the aggregate score of 3.733 indicated that the respondents agreed that reuse, recycle and reduce practices highly influences performance of housing and water projects in Nairobi City County, Kenya which varied significantly as shown by standard deviation of 1.419. Majority of the respondents strongly agreed on the statements that ability to identify and integrate reusable elements into design waste minimization through measures taken in materials procurement Consideration, and prevention of waste through design activities (designing out wastes) as shown by mean score of 3.84, 3.83 and 3.79 respectively with respective variance of 1.468, 1.420 and 1.473. These findings are in line with the findings of Polat and Ballard (2010) established that minimisation is the best and most effective method of reducing the generation of waste and eliminating many of the waste generation problems.

The respondents also agreed that ability to effectively design for preassembled components, recycling target is set for every project and reuse material scraps from cutting stock length material
into shorter pieces as shown by mean score of 3.69, 3.65 and 3.60 and a significance variance of 1.410, 1.236 and 1.506 respectively. These findings are in line with the findings of Greenwood et al. (2012) who found that the top priority in minimizing waste is to avoid waste through designing out or reducing waste at the source and proposed three key project stages where waste minimization initiative should be introduced; contractual, design and site execution stages.

4.4.5 Project Performance

The study sought to establish the influence of construction waste management practices on the performance of housing and water projects in Nairobi City County, Kenya. The findings are presented in Table 4.8.

Table 4.8: Project Performance

<table>
<thead>
<tr>
<th></th>
<th>There is accuracy in projects</th>
<th>Projects are delivered on time</th>
<th>There is no cost overruns in projects</th>
<th>Enhances efficiency in projects activities</th>
<th>Aggregate Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>N Valid</td>
<td>212</td>
<td>212</td>
<td>212</td>
<td>206</td>
<td></td>
</tr>
<tr>
<td>Missing</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>3.68</td>
<td>3.65</td>
<td>3.43</td>
<td>3.14</td>
<td><strong>3.48</strong></td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>1.417</td>
<td>1.675</td>
<td>1.591</td>
<td>1.535</td>
<td><strong>1.554</strong></td>
</tr>
</tbody>
</table>

Source: Survey Data (2018)

From the findings, the aggregate score of 3.48 indicates that construction waste management practices influences the performance of housing and water projects in Nairobi City County, Kenya to a great extent which varied significantly as shown by standard deviation of 1.554. Majority of the respondents strongly agreed that construction waste management practices leads to accuracy in projects with a mean of 3.68 which varied significantly as indicated by standard deviation of 1.417. This was followed by statements that Projects are delivered on time, there is no cost
overruns in projects and Enhances efficiency in projects activities as shown by mean of 3.65, 3.43 and 3.14 respectively and their respective variance of 1.675, 1.591 and 1.535.

These findings agree with the findings of Johnston and Mincks (2011) who proposed an integrated construction waste management plan that includes: reduction, recycling, reuse, incinerating, composting and landfill. Formoso et al. (2014) argue that any inefficiency that results in the use of equipment, materials, labour, or capital in larger quantities than those considered necessary in the production of a building. Waste can be generated by mistakes, working out of sequence, redundant activity and movement, delayed or premature inputs and products or services that do not meet customer needs.

4.5 Inferential Statistics

4.5.1 Correlation Analysis

Correlation analysis was done to show how strongly two variables are related to each other or the degree of association between the two. The findings are presented in Table 4.9.

Table 4.9: Correlation Analysis
The Pearson’s r for the correlation between project design and procurement variables is 0.852 which is close to 1 with a significant value of 0.00 which is less than 0.05. This shows a strong relationship meaning that changes in one variable are strongly correlated with changes in the second variable. Therefore, it can be concluded that there is a strong relationship between project design and procurement. Procurement is strongly related to material handling (r=0.788, p<0.05) which means that increase in procurement leads to increase in material handling and vice versa.

The study established that material handling is strongly related to reuse, recycle and reduce practices (r=0.823, p<0.05) in which it can be concluded that there is a statistically significant
correlations between the two variables. That means, increases or decreases in one variable do significantly relate to increases or decreases in the second variable.

The study also revealed a negative correlation between procurement and reuse, recycle and reduce practices ($r = -0.161$, $p<0.05$). This means that changes in one variable are not correlated with changes in the second variable. It can be concluded that increase in procurement leads to decrease in procurement and reuse, recycle and reduce practices and vice versa.

### 4.5.2 Regression Analysis

Regression analysis was carried out to show which among the independent variables were related to dependent variable. The findings are presented in Table 4.10.

**Table 4.10: Regression Analysis**

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
<th>Change Statistics</th>
<th>Sig. F Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.781a</td>
<td>.609</td>
<td>.589</td>
<td>1.423</td>
<td>R Square Change</td>
<td>.011</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>F Change</td>
<td>.588</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>df1</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>df2</td>
<td>207</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Sig. F Change</td>
<td>.002a</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), Reuse, Recycle and Reduce Practices, Procurement, Project Design, Material Handling

**Source: Survey Data (2018)**

Table 4.10 shows a model summary that provides information about the regression line’s ability to account for the total variation in the dependent variable. $R^2$ also called the coefficient of determination, is the measure of how close the data are to the fitted regression line which is 0.609 (60.9 per cent). The adjusted $R^2$, also called the coefficient of multiple determinations, is the percent of the variance in the dependent explained uniquely or jointly by the independent variables. 0.589 (58.9 per cent) of the changes in the performance of housing and water projects variables could be attributed to the construction waste management practices. This means that other
variables not studied contribute 41.1 per cent of the performance of housing and water projects in Nairobi City County, Kenya.

**Table 4.11: Analysis of Variance (ANOVA)**

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>4.762</td>
<td>4</td>
<td>0.191</td>
<td>5.588</td>
<td>.002a</td>
</tr>
<tr>
<td>Residual</td>
<td>419.063</td>
<td>207</td>
<td>2.024</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>423.825</td>
<td>211</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), Reuse, Recycle and Reduce Practices, Procurement, Project Design, Material Handling

**Source: Survey Data (2018)**

The probability value of 0.02a indicates that the regression model was highly significant in predicting how Reuse, Recycle and Reduce Practices, Procurement, Project Design and Material Handling influenced performance housing and construction projects. The F calculated at 5 per cent level of significance was 5.588 since F calculated is greater than the F critical (value = 0.191), this shows that the overall model was significant.
Table 4.12: Determination of Coefficients

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>95.0 per cent Confidence Interval for B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
</tr>
<tr>
<td>1</td>
<td>(Constant)</td>
<td>0.781</td>
<td>.494</td>
</tr>
<tr>
<td></td>
<td>Project Design</td>
<td>.720</td>
<td>.069</td>
</tr>
<tr>
<td></td>
<td>Material Handling</td>
<td>.613</td>
<td>.131</td>
</tr>
<tr>
<td></td>
<td>Procurement</td>
<td>.594</td>
<td>.138</td>
</tr>
<tr>
<td></td>
<td>Reuse, Recycle and Reduce Practices</td>
<td>.860</td>
<td>.085</td>
</tr>
</tbody>
</table>

a. Dependent Variable: Project Performance

Source: Survey Data (2018)

As shown in Table 4.12, the established regression equation by the study was:

\[ Y = 0.781 + 0.720X_1 + 0.613X_2 + 0.594X_3 + 0.660X_4. \]

Where \( Y = \) Project Performance

\( X_1 = \) Project Design

\( X_2 = \) Material Handling

\( X_3 = \) Procurement

\( X_4 = \) Reuse, Reduce and Recycle Practices

From the results in Table 4.12, holding Project Design, Procurement, Reuse, Reduce and Recycle Practices and Material Handling, performance of housing and water projects would be 0.781. In addition, the findings show that a unit increase in project design, material handling, procurement and reuse, reduce and recycle practices would lead to 0.720, 0.613, 0.594 and 0.860 increase in performance of housing and water projects respectively. Reuse, recycle and reduce practices had
the greatest (86.0 per cent) influence on the performance of housing and water projects followed by project design (72.0 per cent), material handling (61.3 per cent) and lastly procurement (59.4 per cent).

Hao et al. (2013) pointed out that waste management in construction activities should start from the design and the procurement phases and, then, extend to onsite technologies and plans. Formoso et al. (2014) argue that any inefficiency that results in the use of equipment, materials, labour, or capital in larger quantities than those considered necessary in the production of a building. According to Berry and McCarthy (2011) procurement systems deal with risk allocation between the contractor and the employer. Johnston and Mincks (2011) proposed an integrated construction waste management plan that includes: reduction, recycling, reuse, incinerating, composting and landfill.

4.6 Qualitative Analysis

The study established that during project design there are communication benefits of working with a design professional and a construction expert at the same time ensures that potential problems are discovered before the project starts. Communicating the cost implications of design decisions ensures that the owner plays a key role in arriving at the final project price. The design build method helps to remove ambiguity that may arise in material and construction specifications. The relationship built during the design phase helps to ensure that the stage is set for a successful construction project.

The study established that procurement facilitate increased collaboration which in turn enhances project performance. Improvement of procurement procedures is critical increasing the efficiency of the housing and water project development. Procurement allow an organization to realize
immediate upfront cost savings by procuring items, services, and contracts at the best price available.

Material management is an important element in project management as materials contribute a major portion to total project cost. It also plays a key role because of the successes of every construction project rely on having proper resources. Material handling benefit construction players in improving the efficiency of material management in order to minimize the impacts on construction projects performance. The availability and sufficient materials and equipment have effect on time, quality, productivity and performance.

Reduce and reuse materials enables the organization gain immediate cost savings by not needing to purchase as much, or at all. Avoid the production of waste materials where recycling facilities are not easily accessible or available. Central recycle bins are placed where they are easy to access and where the waste or recycling materials are likely to be generated. This helps save valuable resources and prevents environmental damage.
CHAPTER FIVE
SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction
The chapter presents a summary of the findings, conclusions and recommendations as per the research objective.

5.2 Summary of Findings
The general objective was to investigate the influence of construction waste management practices and performance of housing and water projects in Nairobi City County, Kenya. The study’s specific objectives were to establish the influence of project design, material handling, procurement and reuse, recycle and reduce practices. The respondents comprised of 3 permanent staff from each project which formed a population of 285 respondents. The summary of the findings are presented as follows:

The first research objective sought to establish the influence of project design on the performance of housing and water projects in Nairobi City County, Kenya. The study established that project design had a positive and significant effect on performance of housing and water projects in Nairobi City County, Kenya. Project design influence performance of housing and water projects to a great extent. The study established that specifications are detailed and devoid of under/over ordering and waste management plan is prepared along with the design which greatly affects the performance of housing and water projects in Nairobi City County, Kenya.

The second research objective sought to identify the influence of procurement on the performance of housing and water projects in Nairobi City County, Kenya. The study established that procurement had a positive and significant effect and influences performance of projects to
moderate extent. Most of the respondents agreed on the statements that ordering material with high content recycled material, supplier flexibility in providing small quantities of materials, procurement route that minimizes packaging and planning for good delivery schedule onsite influences performance of housing and water construction projects to a great extent.

The third research objective sought to examine the influence of material handling on the performance of housing and water projects in Nairobi City County, Kenya. The study established that material handling had a positive and significant effect on project performance but influences project performance to a moderate extent. Most of the respondents agreed that use of safe materials storage facilities and waste auditing to monitor and record environmental performance onsite. The study also established that there was inadequate site access for material

The fourth research objective sought to investigate the influence of re-use, recycle and reduce practices on the performance of housing and water projects in Nairobi City County, Kenya. The study established that reuse, recycle and reduce practices had a positive and significant effect on performance and that re-use, recycle and reduce practices highly influenced project performance. Majority of the respondents strongly agreed on the statements that ability to identify and integrate reusable elements into design waste minimization through measures taken in materials procurement Consideration, and prevention of waste through design activities (designing out wastes).

5.3 Conclusions

Project design strengthens the owner’s control of the entire design process and minimizes the risks in finance by contracting with a single firm that is unconditionally committed to the success of the project. Project team can work closely together and accurately conceptualize the completed project
at an early stage and evaluate alternative systems, materials and methods efficiently and accurately. Project design allows resources and attention to be productively focused on cost effective solutions that reflect best value and quality.

Procurement helps the organization maintain quality and consistency, effectively, drive compliance and manage risk. Through procurement, managers can negotiate the best deal by identifying the projects needs and establishing the most advantageous position for contracts. These managers evaluate and monitor products and services on an ongoing basis to ensure the outcomes comply with terms and conditions.

Materials handling ensures that the right quality and quantity of materials are appropriately selected, purchased, delivered and handled on site in a timely manner and at a reasonable cost. Materials represent a major expense in construction, so minimizing procurement costs improves opportunities for reducing the overall project costs. On the other hand, materials management can result in increased costs during construction.

Reuse, recycle and reduce practices are vital part in any waste management strategy because they help reduce waste handling and disposal costs, by avoiding the cost of recycling, land filling and combustion. This involves the reprocessing of waste into a usable raw material or product thus enabling materials to have an extended life in addition to reducing resource consumption and avoiding disposal costs.

5.4 Recommendations for Policy and Practice

Project design is an important influencing factor as to why waste is produced in construction projects. Ensuring design decisions prevents waste from being produced in the first place and also positively improves the recycled content and future recyclability of a project. Waste prevention
and reduction in the design phases, project design should focus on reuse and recycling, waste-efficient procurement, materials optimization, off-site construction; and deconstruction and flexibility.

In procurement, contractual agreements should be set up between the client, designers, main contractors and sub-contractors working on the project for effective production of waste. Prospective contractors should be required in their tenders to indicate the likely waste recovery targets and key performance indicators that can be achieved on the project given the stage of the design. The reasons behind this is that the design incorporates good practice levels of waste minimisation, there will be less potential for waste generation on-site and therefore a lower target rate should be adopted accordingly and the contractor is better suited than the client to propose recovery rates based on their working practices.

In material handling, the government should introduce specific legislation governing the handling and disposal of construction wastes and follow up with strict monitoring to ensure compliance. There should be a centralised material management team co-ordination between the site and the organization. Proper control, tracking and monitoring of the system is required. Awareness and accountability should be created within the organization.

For better reuse, recycle and reduce practices, the most effective environmental solution may often be to reduce the generation of waste and the amount of waste created using waste prevention measures. Re-use materials to avoid waste being created and where further reduction is not practicable, products and materials can sometimes be re-used, either for the same or a different purpose. Recycle materials from site where materials cannot be re-used and value should be recovered from waste, through recycling, composting or energy recovery from waste.
5.5 Recommendations for Further Studies

The study focused on how project design, material handling, procurement and reuse, recycle and reduce practices influence performance of housing and water projects. Therefore, the study recommends that further studies should be carried out focusing on other variables not studied influence the performance of other projects in the construction industry.
REFERENCES


Solanke, B. H. (2015). Effective strategy for construction materials procurement during construction towards the enhancement of sustainable building production in Western Cape, South Africa (Doctoral dissertation, Cape Peninsula University of Technology).


APPENDICES

Appendix I: Letter of Introduction

David Gitau
P.O Box 1457
Nairobi

Dear Sir /Madam

Re: Request for Participation in Research Study

I am a postgraduate student at Kenyatta University undertaking a study entitled: Construction Waste Management Practices and Performance of Construction Projects in Nairobi City County, Kenya as a requirement for the Degree of Master’s in Business Administration (Project Management).

Since you are better placed to provide information required for this study, I have selected you as my study respondent. You are kindly supposed to rate yourself as per the question items given. Please take a few minutes to respond to the questionnaire items. I assure you that your answers will be kept completely confidential and will be used for academic purposes only. Your participation in facilitating this study will be highly appreciated.

Any assistance will be highly appreciated. Thank you.

Yours faithfully

Sign……………………………………………Date………………………………

David Gitau
MBA Student- KU (City Campus)
Appendix II: Questionnaire

This questionnaire is to gather information on Construction Waste Management Practices and Performance of Construction Projects in Nairobi City County, Kenya. Please tick on the box corresponding to your response.

Section A: Background Information

1. Indicate your Gender: [ ] Male [ ] Female

2. Age:
   - Less than 25 years [ ]
   - 25 – 34 Years [ ]
   - 35 – 44 Years [ ]
   - 45 years and above [ ]

3. Indicate your highest level of education
   - [ ] Diploma
   - [ ] Post Graduate Diploma
   - [ ] Bachelors Degree
   - [ ] Master’s Degree

4. Indicate your work experience:
   - [ ] Less than 5 years
   - [ ] 5-9 years
   - [ ] 10-15 years
   - [ ] Above 15 Years

Section B: Project Design

To what extent do you agree with the following statements concerning the influence of project design on the performance of construction projects in Nairobi County, Kenya?

**Key:** Strongly agree(SA)=5, Agree(A)=4, Undecided(U)=3, Disagree(D)=2, and Strongly Disagree(SD)=1

<table>
<thead>
<tr>
<th>Statement</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specify durable materials to avoid need for early replacement</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Specification are detailed and devoid of under/over ordering</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Waste management plan is prepared along with the design

Knowledge and ability to design for standard materials supply

Ability to coordinate dimensions of building elements and components

Awareness of material quantity, quality and durability

5. Based on your opinion, how does project design the performance of construction projects in Nairobi County, Kenya?

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

Section B: Procurement

To what extent do you agree with the following statements concerning the influence of procurement on the performance of construction projects in Nairobi County, Kenya?

<table>
<thead>
<tr>
<th>Statement</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supplier flexibility in providing small quantities of materials</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Procurement route that minimizes packaging</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Order material with high content recycled material</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vendors that supply quality and recycled materials</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Planning for good delivery schedule onsite</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduced excess order to avoid breakage</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6. Based on your opinion, how does procurement the performance of construction projects in Nairobi County, Kenya?

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

Section D: Material Handling
To what extent do you agree with the following statements concerning the influence of material handling on the performance of construction projects in Nairobi County, Kenya?

<table>
<thead>
<tr>
<th>Statement</th>
<th>1</th>
<th>2</th>
<th>3</th>
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</thead>
<tbody>
<tr>
<td>Use of safe materials storage facilities</td>
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<tr>
<td>Prevention of double handling of materials</td>
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<tr>
<td>Providing bins for collecting wastes for each of the sub-contractor</td>
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<tr>
<td>Adequate site access for material delivery and movement</td>
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<tr>
<td>Waste auditing to monitor and record environmental performance onsite</td>
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<tr>
<td>Dedicated space for sorting of waste</td>
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</table>

7. Based on your opinion, how does material handling the performance of construction projects in Nairobi County, Kenya?

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Section E: Reuse, Reduce and Recycle Practices

To what extent do you agree with the following statements concerning the influence of reuse, reduce and recycling practices on the performance of construction projects in Nairobi County, Kenya?

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<th>Statement</th>
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</thead>
<tbody>
<tr>
<td>Recycling target is set for every project</td>
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<tr>
<td>Reuse material scraps from cutting stock length material into shorter pieces</td>
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<tr>
<td>Waste minimization through measures taken in materials procurement</td>
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<tr>
<td>Ability to identify and integrate reusable elements into design</td>
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</tbody>
</table>
8. Based on your opinion, how do reuse, recycle and reduce practices influence the performance of construction projects in Nairobi County, Kenya?

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Section F: Performance of Construction Projects

To what extent do you agree with the following indicators concerning the influence of construction waste management practices on the performance of construction projects in Nairobi County, Kenya?

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<th>Statement</th>
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</thead>
<tbody>
<tr>
<td>ICT adoption has enabled Tea companies to expand its market network</td>
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<tr>
<td>ICT adoption has enabled Tea companies to gain more profits</td>
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<td>ICT adoption has led to effective operations in Tea companies</td>
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</table>
Appendix III: Research Authorization

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Ref. No. NACOSTI/P/18/47003/22514 Date: 24th May, 2018

David Kio Gitau
Kenyatta University
P.O. Box 43844-00100
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on “Construction waste management practices and performance of housing and water projects in Nairobi City County, Kenya,” I am pleased to inform you that you have been authorized to undertake research in Nairobi County for the period ending 22nd May, 2019.

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

Kindly note that, as an applicant who has been licensed under the Science, Technology and Innovation Act, 2013 to conduct research in Kenya, you shall deposit a copy of the final research report to the Commission within one year of completion. The soft copy of the same should be submitted through the Online Research Information System.

GODFREY P. KALERWA MSc., MBA, MKIM
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The County Commissioner
Nairobi County.

The County Director of Education
Nairobi County.
Appendix IV: Research Permit

THIS IS TO CERTIFY THAT:

MR. DAVID KIO GITAU
of KENYATTA UNIVERSITY, 43844-100
Nairobi, has been permitted to conduct research in Nairobi County

on the topic: CONSTRUCTION WASTE MANAGEMENT PRACTICES AND PERFORMANCE OF HOUSING AND WATER PROJECTS IN NAIROBI CITY COUNTY, KENYA

for the period ending: 22nd May, 2019

Signature

Permit No: NACOSTI/P/18/47003/22514
Date Of Issue: 24th May, 2018
Fee Received: Ksh 1000

Director General
National Commission for Science, Technology & Innovation

Kaleru
CONDITIONS

1. The Licence is valid for the proposed research, research site specified period.
2. Both the Licence and any rights thereunder are non-transferable.
3. Upon request of the Commission, the Licensee shall submit a progress report.
4. The Licensee shall report to the County Director of Education and County Governor in the area of research before commencement of the research.
5. Excavation, filming and collection of specimens are subject to further permissions from relevant Government agencies.
6. This Licence does not give authority to transfer research materials.
7. The Licensee shall submit two (2) hard copies and upload a soft copy of their final report.
8. The Commission reserves the right to modify the conditions of this Licence including its cancellation without prior notice.

REPUBLIC OF KENYA

National Commission for Science, Technology and Innovation

RESEARCH CLEARANCE PERMIT

Serial No.A 18586

CONDITIONS: see back page