

**EFFECT OF CONSTRUCTION OF SUSTAINABLE STOREY
OFFICE BUILDINGS ON OCCUPANTS' SAFETY; A CASE
OF ELDORET MUNICIPALITY, KENYA**

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DECLARATION

This research project is my original work and has not been presented for a degree in any other university or institution for examination.

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This research project has been submitted for examination with my approval as the University supervisor.

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DEDICATION

To my beloved husband Ernest Korir Olbara; to my dear children Gilbert Kipruto, Caroline Jepkemboi, Sylvia Jelagat, Kevin Kipkoech, Sharon Jepkoskei whose support and love I treasure; and my grandson Kealan Jabari who gives me great pleasure; to my mother Tapkili Teriki Tanui for always being there for me.

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LIST OF ABBREVIATIONS AND ACRONYMS

API -	Australian Property Institute
CBD -	Central Business District
EIA-	Environmental Impact Assessment
HVAC-	Heating, Ventilating, and Air Conditioning Systems
NEMA-	National Environmental Management Authority
NGOs-	Non Governmental Organizations
OCP-	Official Community Plan
SCC -	Sacramento County Code
TBL-	Triple Bottom Line
WSMF-	Welded Steel Moment-Resisting Frame

ABSTRACT

The main purpose of the study was to investigate effect of construction of sustainable storey office buildings on occupants' safety taking a case of Eldoret Municipality. The research was guided by the objectives including; to determine the effect of technical personnel on the construction of safe sustainable storey buildings; to establish the effect of quality of building materials on the construction of safe sustainable storey buildings; to establish the effect of building regulations on the construction of safe sustainable storey buildings and to examine the effect of construction cost on development of safe sustainable storey buildings in Eldoret Municipality. The study adopted a survey design and drew a sample of 201 respondents from a population of 402 respondents. Data was collected using questionnaires and interview schedules. Data was analysed through adaptation of qualitative methods whereby descriptive statistics were employed. The study findings were presented and recommendations made. The study found out that the technical personnel in the construction industry play a crucial role in ensuring safe sustainable buildings. It was also clear that poor quality materials is sometimes used to build as well there was an agreement that there was weak enforcement of the by laws concerning the building industry. Construction cost was agreed to hinder safe sustainable building construction. The study further made some recommendations which include; that the technical personnel in the construction industry must work in coherence in order to ensure safe sustainable buildings; the contractors and designers need to be compelled to stick to the required standards of materials for construction of storey building; Provision of financial incentives to encourage sustainability building by willing investors should be emphasized by the government authorities and formulation of laws that abide with safe sustainable building in the industry

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Sustainable building refers to a structure and using process that is environmentally responsible and resource-efficient throughout a building's life-cycle: from sitting to design, construction, operation, maintenance, renovation, and demolition. The concept of sustainable building is simple; build structures to be more efficient (Ji and Plainiotis, 2006). According to Yudelson (2008), a sustainable building is a high-performance property that considers and reduces its impact on the environment and human health, designed to use less energy and water and to reduce the life-cycle environmental impacts of the materials used, and achieved through better sitting, design, material selection, construction, operation, maintenance, removal, and possible reuse.

There are many examples of inefficient storey building in many towns across the urban areas in the world. A United States Department of Energy report records that most conventional buildings consume a lot of land as well as excessive amounts of energy, water, and other resources. In the United States in 2005, buildings share of the total energy used was 40.2 percent (U.S. Department of Energy, 2011). Buildings are inefficient and waste valuable resources because of poor insulation, leaky windows, inefficient lighting, heating, ventilating, and air conditioning systems (HVAC), and poor construction techniques.

Buchanan (2011) notes that an office building's HVAC system is a main consumer of energy; because the design of the system is to produce a cooling-dominated place. Therefore, most office buildings have fixed and permanent window systems.

Fixed windows are convenient when designing a building's mechanical system, but result in its occupants relying on energy-consuming equipment for ventilation and temperature control. The continuous running of a HVAC system results in additional maintenance costs and a shorter shelf life for the equipment. In addition to the replacement costs, the replaced equipment ends up in the landfill. This can also prove to be unsafe in circumstances where the storey building state degrades without notice.

Building and construction is linked to all other major sectors including mining, manufacturing, agriculture and transport because this is where the raw materials are derived from. The current main environmental issue of global warming holds particular importance to the building and construction sector. Most of the inefficient buildings are likely to contribute to environmental pollution. This will in return lead to climatic changes that are adverse to human and other animals as well as plants community. According to the IPCC (2007), there is a 90 percent chance that the Earth is getting warmer, a 90 percent chance that humans have caused it, and it is a virtual certainty that the warming will continue into the next century. Despite these grim conclusions, the IPCC report says there is still time to slow global warming and lessen many of its most severe consequences if we act quickly. Global warming has an impact to the quality of the raw materials and this prompts the increased concerns over the quality of raw materials used in building storey buildings.

Most of the natural resources that exist are likely to be depleted if the conditions are not put to control. Inefficient buildings are also an ingredient of depletion of the natural resources. As Buchanan (2011) records, the sprawling suburbs are a major environmental concern because site selection is done in unsustainable manner. Even a

deserted piece of land can have a delicate ecosystem with plants, animals, and organisms living together. A subdivision's construction activities, infrastructure, and buildings can permanently destroy an ecosystem. Therefore, many people are against any type of development in certain areas and believe some land should remain vacant into eternity.

Conventional building is a private good that is bought and sold and is excludable. However, its inefficiencies and location result in negative externalities that significantly affect public goods (i.e. clean air). To that extent, this situation makes a conventional building a public good, which is non-excludable and non-rival in consumption, because the public breathes the dirty air regardless if they use the conventional building (Buchanan, 2011).

Another aspect of safer building is the presence of fire protection equipment in buildings. Hall (2010) analyzed statistics from fires reported to U.S. municipal fire departments and found that fire sprinklers save lives and are effective and reliable. For example, the statistics indicate that the death rate per fire in homes fully equipped with sprinklers is lower by 83 percent. In addition, in reported structure fires large enough to activate them, sprinklers operated and were effective in 87 percent of fires in such properties (Hall, 2010). With these results, many authorities estimate the cost per life saved from installing fire sprinklers. Some states posit that beneficial to require homebuilders to install fire sprinklers in all new residential construction (2010 California Residential Code, R313.2). This code is not likely to be in the Kenya context as many deaths through inferno break out have been recorded in the recent past. This is evidence on the inefficiency in implementation of the building code in the towns in Kenya.

Another concern on construction industry is the social issues. The social issues of affordability, liveability and livelihood are impacted by building and construction. These are affected in terms of urban form and transport, social cohesion and liveable communities, quality of housing or building product and also lifestyle (Engelman, Halweil *et al*, 2000). Economically, building and construction sector has a profound influence on all other sectors and is often used by governments as a measure of economic growth (HIA, 2002). Economic benefits achieved by the sector through the implementation of sustainability that will be felt by the provision of a more superior product, will be realised directly through reduced consumption and waste, specifically in terms of energy-efficiency measures, as well as efficiency in water use and disposal. Other savings can be realised though the construction of more adaptable, durable, and long-life buildings (CSIRO, 2002).

The governments in different countries have had to come up with building code which is aimed at ensuring efficient buildings that are 'green' or sustainable. The building codes help facilitate safer buildings by requiring minimum standards for buildings, including foundation, roofing, plumbing, electrical, and other specifications for safety and sanitation (Friedman, Harris, and Linderman, 2004). Safety and sanitation are important elements of building codes; however, there are other goals of building codes. According to the Sacramento County Code (2007), building codes are meant to safeguard. They are meant to ensure no life or limb is lost as well as ensures health, property and public welfare is secured by regulating and controlling the design, construction, installation, quality of materials, use and occupancy, location and of all buildings and structures.

Even though these countries are determined to ensure the building codes are effectively achieved, many barriers to achieving sustainable building are being witnessed. Several barriers are identified in different literature ranging from lack of interest in or demand for sustainable building from the owners or developers, lack of training and education in sustainable construction, failure of service fee structures to account for the recovery of long-term savings, and the higher costs (both real and perceived) of sustainable building options.

Duda (2009) states that the largest barrier facing the implementation of sustainable building is perceived financial risk associated with event beyond the control of the owner or unexpected due to lack of examples and research. Craig (2008) argues in line with Tyler, by exuding that many developers want to say their buildings are 'green', and yet the truth of the matter is they are motivated in just having profit. Craig further notes that there is need to have local evidence to show them that green building pay in the long run as opposed to the short term.

Many developers would prefer low cost and lower risk building. Even though costs for green buildings could be reduced by knowledge gained over time from experience there will always be a significant cost in the design and specification due to the nature of the treatment requiring specialist input (Duda 2009). Wheeler (2009) notes the failure of developing prolific, wide spread solar water heating in Australian dwellings to cost, the lack of direct financial incentives, including government funding to assist with research and development during the design phase and lack of knowledge are a core problem in ensuring sustainable building.

One of the important roles of planners and urban designers is avoiding publicity stunt and trends that become outdated but at the same time ensuring a high level of amenity and built urban form that is sustainable for the longer term. Nevertheless, Duda (2009) assert that policy makers often wait until something undesirable or catastrophic happens before they implement controls and policy to resolve issues. By considering the potential health risks, cumulative impact, potential organic waste removal issues and climatic site specific issues an attempt to avoid a potential undesirable or catastrophic situation should be deployed. There are a number of problems that combine to make developing principles for this a significant task.

Williams and Dair (2006) note that by 2003 there was still a perception that progress in sustainable building was insufficient, hence a ‘Sustainable Building Task Group’ was established to identify how government and industry could improve the sustainability and quality of buildings. This group reported in 2004 on the steps required to accelerate a shift to a more sustainable built environment and identified the need for a recognized code for sustainable buildings, further changes to planning and building regulations and better information and skills, as well as fiscal incentives for owners and occupiers of buildings (Sustainable Buildings Task Group, 2004). Many of these recommendations are now being auctioned by government (UK Government, 2005). A review of sustainable building activity found that a very small proportion of England’s building stock can claim to be sustainable in any way, whether judged on sustainable construction, design or performance in use (Williams and Lindsay, 2005).

1.2 Statement of the Problem

Safe sustainable building which is sometimes referred to as green building has remained a subject of discussion in many urban management authorities. Safety has such an impact on the value of a storey building, and thus higher attention has been placed on safety provisions in the building to avoid disasters. Safe sustainable storey building has been an evasive practice in most cities due to some aspects that hinder its implementation. Inadequate training, poor quality of materials, cost of building and weak regulations are among the inhibitors of safe sustainable storey buildings.

There is increased concern in the trending fall of storey buildings even before their launch hence resulting to damages as well as loss of many lives. Most towns in Kenya have put in place mechanisms to achieve safe sustainable buildings. There is a building code that is deemed to guide the contractors of all buildings that are developed. Nevertheless, there are many cases where this code is not adhered to and it is evidenced in the many cases where buildings fall and many lives and property is lost. The fire tragedies that take place cause many losses as opposed to if the buildings are sustainable through adherence to the building code. At this point it is clear barriers to sustainable building exist.

The barriers are prevalent and hence the wide spread disorder across the towns in Kenya. The problems range from lack of interest in or demand for sustainable building from the owners or developers, lack of training and education in sustainable construction, failure of service fee structures to account for the recovery of long-term savings, and the higher costs (both real and perceived) of sustainable building options. Policy makers often wait until something undesirable or catastrophic happens before they implement

controls and policy to resolve issues (Duda, 2009). This study was meant to evaluate the influence of construction of sustainable building on the safety of storey building. It took a case of Eldoret Municipality since there is evidence of inefficient buildings in the town and in turn poses negative impacts on social, economic and environmental health of the office occupants.

1.3 Purpose of the Study

The main purpose of the study was to evaluate effect of construction of sustainable storey office building on occupants' safety within the Eldoret Municipality.

1.4 Objectives of the Study

The aim of the study was achieved through the following research objectives:

1. To determine the effect of technical personnel on the construction of safe sustainable storey buildings in Eldoret Municipality
2. To establish the effect of quality of building materials on the construction of safe sustainable storey buildings in Eldoret Municipality
3. To establish the effect of building regulations on the construction of safe sustainable storey buildings in Eldoret Municipality
4. To examine the effect of construction cost on development of safe sustainable storey buildings in Eldoret Municipality

1.5 Research Questions

1. What is the effect of technical personnel on the construction of safe sustainable storey buildings in Eldoret Municipality?
2. What is the effect of quality of building materials on the construction of safe sustainable storey buildings in Eldoret Municipality?
3. What is the effect of building regulations on the construction of safe sustainable storey buildings in Eldoret Municipality?
4. What is the effect of construction cost on development of safe sustainable storey buildings in Eldoret Municipality?

1.6 Significance of the Study

It was expected that the study will inform the Management of Eldoret Municipality, Department of Public Works, Department of Housing, National Construction Authority and other stakeholders in the construction industry on issues that concern sustainable storey buildings and occupant safety. The study was deemed to aid management of Eldoret Municipality to come up with strategies to be able to meet the challenges of change in the future with the implementation of sustainable building which is an ingredient of safe buildings. It is deemed to further assist other municipalities to manage the challenges of establishing sustainable buildings. The study is also expected to increase knowledge in the area of research in strategies of enhancing sustainable building. This was expected to be useful to policy makers on sustainable building laws and students who would wish to carry out further research.

1.7 Basic Assumptions of the Study

The study assumed that there exist some hindrances to the sustainable building in Eldoret Municipality. It further assumed that all the sampled respondents had a common understanding on the issues in the tools of data collection. It was also assumed that the respondents are acquainted to the building code and other regulations that govern the building industry.

1.8 Limitations of the Study

One of the limitations of this study was that the findings in Eldoret Municipality may not be able to be generalized to other urban areas such as Nairobi City and even in other smaller towns that might need a different approach to the problem under study. Further the study only the effect of sustainable building on the safety of the occupants. The study used questionnaires, which though appropriate, have their own limitations. Some respondents did not complete answering the questions, while others failed to provide genuine responses. The researcher appealed to the respondents individually for their utmost cooperation. The researcher, however cross-checked the details provided by the respondents with the information got from the interviews.

1.9 Delimitations of the Study

The study was limited to the main aim mentioned which was to evaluate the effect of construction of sustainable storey office building on occupants' safety. The study was limited to respondents and buildings within Eldoret Municipality in Uasin Gishu County

Kenya. The study focused on the occupants, designers, owners and contractors as the key respondents.

1.10 Organization of the Study

This project report is organised into five chapters. Chapter one consists of the background of the study, statement of the problem , purpose of the study, research objectives, research questions, significance of the study, delimitations of the study, limitations of the study, and basic assumptions of the study. Chapter two covers literature review which is divided into various topics in accordance with the objectives. The theoretical and conceptual framework is provided at the end of the chapter linking the independent and the dependent variables of the study. Chapter three constitutes the research methodology which is divided into eleven subthemes: research design, study area, target population, sample size and sampling technique, research instruments, data collection procedure, validity of instruments, reliability of instruments, data analysis procedure and ethical considerations. Chapter four constitutes of data analysis, presentation, and interpretation. The sections are organized as per the objectives of the study. Finally chapter five constitutes of the discussion, conclusions drawn, recommendations and suggestions for further research.

1.11 Definition of Significant Terms

Building- is any human made structure used or intended for supporting or sheltering any use or continuous occupancy. It is also the act of construction that is the activity of building.

By-laws- these are the regulations that have been crafted and enforced by municipalities to control the quality of the buildings within their jurisdiction. It is usually put in a document referred to as building code.

Financial incentives- it is an activity aimed to boost the interest of those people who will never be compelled by the environmental reasoning behind sustainable building, and also to even the playing field for those who are compelled.

Fundi- Artisan- These are people who do the actual building works e.g Mason, Plumber, Electrician, Carpenter e.t.c.

Green building- the term is used interchangeably with sustainable building.

Industry education- refers to creating awareness over some aspects to all the stakeholders in the construction industry.

Safety- is the state of or condition of being protected against physical, social, spiritual, financial, political, motional, occupational, psychological, educational or other types of consequences of failure, damage, error, accidents, harm or any other event which could be considered non- desirable. In this study also implies a real risk of death and injury or damage to property.

Stakeholder- these are the people or institutions which are party to the building industry including the government, the building design team or professionals,

artisans, contractors, financiers, tenants, landowners and special interest groups.

Storey building- is any level part of a building that can be used by people for living, work, storage, recreation e.t.c.

Supervisors – These are the technical staffs that oversee construction works at the site e.g. foreman clerk of works, site agent.

Sustainable building-Sustainable building refers to a structure and using process that is environmentally responsible and resource-efficient throughout a building's life-cycle: from sitting to design, construction, operation, maintenance, renovation, and demolition.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter presents the review of literature on the factors that affect achievement of sustainable building. The literature covered in this section came from books; journals, websites, conference proceedings and government documents. The chapter sections are based on the objectives of the research.

2.2 Sustainable Storey Building in Municipalities

Sustainable storey building is the design and construction using methods and materials that are resource efficient and that do not compromise the health of the environment or the associated health and well-being of the building's occupants, construction workers, the general public, or future generations. This is clearly an ideal state to work towards. Building has and will always have some impacts on the land and its resources, but these impacts should be minimized as much as possible (Lynch and Hack, 1984). Buildings create indoor sub-environments within our larger natural environment, with their own climate, light levels, and air and water flow systems. As Spim (1984) said that buildings are mini ecosystems. It is no wonder that the quality of those conditions has a serious effect on occupant health and well-being (Spim, 1984).

Construction is said to be sustainable when it meets environmental challenges, responds to social and cultural demands and delivers economic improvement. For example, a building could be considered environmentally sustainable if the energy usage throughout the building's life cycle is low and it considers reusing of materials at the end

of the building's life (Blauert and Zadek, 1998). The fundamental concept of sustainable construction is to deliver long term affordability, quality and efficiency, value to clients and users, whilst decreasing negative environmental impacts and increasing the economic sustainability. It requires the development of enlightened institutions and infrastructures, appropriate management of risks and uncertainties and information and knowledge to assure intergenerational equity and conservation of the ability of earth's natural systems to serve humankind (Majdalani, Ajam, and Mezher, 2006).

Sustainability indicators of buildings is based on the argument that sustainable construction brings about the required performance with the least unfavourable environmental impact, while encouraging economic, social and cultural improvement at a local, regional and global level (Häkkinen, 2007). Sustainability is presented as an agenda that extends beyond economic viability and environmental regeneration, reaching deep into the structure of social organizations, by insisting on social equity and justice (Glass, 2012). The social aspect is seen in reforms of housing and planning—a new approach to how to build, to achieve development that meets the economic, social and environmental needs of future generations. Sustainable construction supply chain delivers tangible benefits to the triple bottom line (TBL) that is (1) Economic Growth (2) Environmental Sustainability and (3) Ethical/Social Performance (Glass, 2012).

According to UNEP (2006) sustainable building and construction should have characteristics like; routinely designed and maintained to optimize the entire life span; sustainability considerations and requirements should take in building legislation and standards; environmental aspects should be considered in the project and should include short-term as well as long-term aspects; policies and incentives provided by the

government to support sustainable building and construction practices and investors, insurance companies, property developers and buyer of buildings are aware of sustainability considerations and should take an active role to encourage sustainable building and construction practice.

In recent years as building form changed in the bid to gain efficiency, designers have over looked opportunity for inclusions of green exteriors in their building forms. Interest in roof gardens is a relatively recent phenomena even though there have been a significant amount of flat roof in building designed in the last 50 years, whilst designers and engineers have struggled to manage storm water (McGillick, 2006). The concept of sustainability in building and construction has evolved over many years. The initial focus was on how to deal with the issue of limited resources, especially energy, and on how to reduce impacts on the natural environment. Emphasis was placed on technical issues such as materials, building components, construction technologies and energy related design concepts. More recently, an appreciation of the significance of non-technical issues has grown. It is now recognized that economic and social sustainability are important, as are the cultural heritage aspects of the built environment (Harlan, 2008).

Still, sustainable construction adopts different approaches and is accorded different priorities in different countries. It is not surprising that there are widely divergent views and interpretations between countries with developed market economies and those with developing economies. Countries with mature economies are in the position of being able to devote greater attention to creating more sustainable buildings by upgrading the existing building stock through the application of new developments or the invention and use of innovative technologies for energy and material savings, while

developing countries are more likely to focus on social equality and economic sustainability (Harlan, 2008).

There are many benefits that follow the adoption of sustainable building. Improved health, comfort, and productivity of occupants and construction workers; and related savings for their employers are a major benefit. Improvements in a building's air quality and day lighting can make for healthier and happier occupants. In a workplace context, this means reduced labour costs and liability risk for employers, because of less absenteeism (fewer sick days) and lower health care costs, for example indoor environment improvements. It is also evident that sustainable building leads also to lower construction costs, mainly through materials use reduction and savings on disposal costs because of recycling, as well by downsizing mechanical equipment and avoiding certain infrastructure extension fees increased building value. It is important for owners and developers to remember that the cheapest development is not necessarily the most profitable. Putting environmentally-sensitive features into a building enhances its quality and adds value, just as putting in typical amenities does (Wilson, *et al.*, 1998).

In North America, people spend almost 90 percent of their time inside buildings. Poor design and construction practices can have a significant effect on the health of the building's occupants and can produce buildings that are expensive to operate and maintain, and costly to renovate to accommodate the occupants' changing needs or life stages. These impacts disproportionately affect the elderly and less affluent social groups, (Girardet, 1999).

As appealing as green buildings may sound, they currently make up only a fraction of all new building construction in North America. This is due, in part, to the existence of numerous barriers that inhibit the wide-scale adoption of green building as well as to the large number of actors, levels of government, and regulations involved in the building industry. A North American vision for green residential building, supported by national and local strategies, could assist in overcoming these barriers. For example, a common vision would see resource-efficient, low impact, energy-efficient, healthy housing as the norm instead of the exception. This could be achieved through the creation of a common set of sustainability principles, accepted green standards, and planning tools for green construction, with each country having region/context appropriate policies and programs to address differences in building codes, regulatory environments, and climate. These planning tools would be used to enhance quality of life and balance environmental, economic, and social considerations (McGillick, 2006).

2.3 Effect of Technical Personnel on the Construction of Safe Sustainable Building

There are multiple reasons why education and training are important to a successful sustainable building program. In order to get building professionals onboard and increase enthusiasm among laypeople, it is necessary for people to be educated about the pros and cons of green building. Providing people with educational material allows them to make their own informed decisions (Telegen, 2005). One of the most common conclusions people make about sustainable building is that the costs are prohibitive or at least significantly more than traditional construction methods. There have been a few studies that have come out recently claiming that green building, on average, costs less than 2%

more upfront (Kats 2003). When the long-term lifecycle of the building is considered, this number may decrease, making it more economically sound to build sustainably.

In the Boston area, a resolution to this issue is in the works. The Green Roundtable, a non-profit organization dedicated to championing the green building cause, has neared completion on a sustainable design resource library that was to be online by September 2005 (Green Roundtable website, 2005). The resource centre, called Nexus, was deemed to house exhibits on green design and construction, a resource library, showroom floor, educational opportunities, and social events. Admission to the centre, which will be located in downtown Boston, close to many public transportation options, will be free (Green Roundtable Newsletter, 2005). It is not enough to simply make information available. The information should come from a trusted source, and most importantly, it must be accurate. The opening of the Nexus centre should create an access point for interested parties to find accurate, honest information on sustainable building.

While considering the resource centre as a solution to the lack of accessible information and materials on sustainable design, the issue that there will still be an information gap persists. It would be irresponsible to urge the governor to adopt green building legislation, potentially requiring all Massachusetts public facilities to be built to LEED standards, without a solid, well-informed foundation of facts and figures. Since the green building movement is relatively new (within the last twenty years), it is necessary to be cautious and always ask questions. If a few studies claim green building increases costs by 2%, and a few other studies claim the cost increases are more at a 20% range, how will the roundtable know which claim is the correct one (Telegen, 2005).

There is an information gap in sustainable design with regards to costs because critical information is not readily available. Examining the life cycle cost of a building also plays a role and can be tricky. It is not as easy to determine the exact overall life cycle cost savings a building may accumulate over the course of twenty years. Forecasts may certainly be made. Because of this, and because the green building movement is not robust in terms of years, it may be more difficult to obtain long-term data. This is where case studies and research play a critical role (Telegen, 2005).

Insufficient/lack of communication is another aspect to the education and training barrier. This includes a deficiency in the integration of various design and construction professionals (like architects, contractors, building users and owners, and engineers). When information sources cannot connect with an audience, a rift is created and there is a noticeable lack of reliable information. Politics, turf and authority issues, and competing priorities round out this list of causes for this barrier (Telegen, 2005).

2.4 Quality of Building Materials on Development of Sustainable Buildings

Every building project involves the choice of building materials or means used for the selection process (Flórez, Castro-Lacouture, Sefair, Medaglia, 2009). As with the design process, cautious consideration of contextual preconditions is crucial to selecting appropriate building materials or products (Rahman, Perera, and Odeyinka, 2008). In addition, selecting suitable building material options can be a very complex process, being influenced and determined by numerous preconditions, decisions, and considerations. In other words, in choosing the right material, there is not always a single definite criterion of selection, which means designers or architects have to take into

account a large number of material selection factors. Therefore, the available information or data on building material and product options must be constantly evaluated to make well-considered and justifiable material choices, during the design-decision making and selection processes.

With the evolution of the low-carbon building movement, research and development are increasingly devoting considerable amount of resources to deliberately promote and prioritize the use of local and recycled building materials in mainstream practice . Recent studies now argue that the use of local and recycled building materials offers the advantage of reducing CO2 emissions, producing healthier buildings, while also strengthening the local economy.

Pollution prevention measures taken during the manufacturing process can contribute significantly to environmental sustainability. Identical building materials may be produced by several manufacturers using various processes. Some manufacturers are more conscientious than others about where their raw materials come from and how they are gathered. While all industries are bound to some extent by government regulations on pollution, some individual companies go far beyond legal requirements in ensuring that their processes pollute as little as possible. These companies are constantly studying and revising how they produce goods to both improve efficiency and reduce the amount of waste and pollutants that leave the factory. In effect, they perform their own life cycle analysis of internal processes (Kim and Rigdon, 1998).

Selecting materials manufactured by environmentally responsible companies encourages their efforts at pollution prevention. Although these products may have an initially higher “off-the-shelf” price, choosing products that generate higher levels of

pollution exploits the environment. The “law of supply and demand” also works in reverse: reduced demand for a product results in lower production. Lowered production means less waste discharged and less energy consumed during manufacturing, as well as a lower volume of raw materials that must be gathered. Packaging that is environmentally sound can be pollution prevention feature, as the way in which a product is packaged and shipped affects the total amount of waste it generates (Kim and Rigdon, 1998).

Water is used in large quantities in many manufacturing processes, especially in the production of paper, cement, and metals. This wastewater is often released directly into streams and can contain toxic substances. Dye used for colouring paper and carpet fiber is examples of environmental contaminants that escape freely into the waste stream. By becoming aware of which manufacturers use environmentally sustainable manufacturing methods, specifying their products, and avoiding goods produced through highly polluting methods, architects can encourage the marketing of sustainable building materials (Kim and Rigdon 1998).

Scrap may come from the various moulding, trimming, and finishing processes, or from defective and damaged products. Products with this feature may incorporate scrap materials or removed them for recycling elsewhere. Some industries can power their operations by using waste products generated on-site or by other industries. These options reduce the waste that goes into landfills. Reducing waste in the manufacturing process increases the resource efficiency of building materials. Concrete can incorporate fly ash from smelting operations. Brick, once fired, is inert, not reacting with the environment. The firing process can be used to encapsulate low-level toxic waste into the brick, reducing the dangers of landfill disposal. Water used for cooling equipment or

mixing can be filtered and reused rather than discharged into the waste stream (Kim and Rigdon 1998). The construction industry is one of the most dynamic, risky and challenging business sectors. There is much waste and it encounters problems caused by narrow-minded control (Mills, 2001). Previous research carried out in the field recommends that the construction sector must shift from being reactive to being more proactive and promote sustainable practices.

2.5 Building Regulations on Development of Safe Sustainable Storey Buildings

A main goal of building regulations, or more specifically building codes, is to protect the public. It is in the public's best interest to have safe buildings; however, at what cost? Most people would agree it is not economically feasible to mandate costly safety precautions on every product that could potentially make a building safer. If we did so, over-regulating could make everything too expensive. Therefore, there needs to be a balance between public safety and financial reasoning (Battenbough, 2009).

In California, the California Building Standards Commission adopts building codes that local governments must use, allowing for local variations in climatic, geological, or topographical conditions. Building codes help facilitate safer buildings by requiring minimum standards for buildings, including foundation, roofing, plumbing, electrical, and other specifications for safety and sanitation (Friedman, Harris and Linderman, 2004). Safety and sanitation are important elements of building codes; however, there are other goals of building codes. According to the Sacramento County Code (SCC 1376 2007), building codes safeguard life or limb, health, property and public welfare by regulating and controlling the design, construction, installation, quality of

materials, use and occupancy, location and of all buildings and structures within this jurisdiction, and certain equipment specifically regulated herein, (Friedman, *et al.*, 2004).

Many universities spend considerable resources testing building materials in labs for the next generation of building codes, particularly building materials to withstand earthquakes. In California, there is special consideration for the structural integrity of a building because of the risk of earthquakes. Unfortunately, it is not until an earthquake happens that we know whether seismic code requirements are entirely effective. For example, one the most surprising results of the Northridge earthquake on January 17, 2004 was the damage to numerous steel buildings. A case study of several damaged, steel buildings found that there were widespread brittle fractures in welded steel moment-resisting frame (WSMF) buildings. Fortunately, there were no casualties or complete collapses because of these structure fractures and many of the case study buildings proved to be stronger than the design forces incorporated in building codes (Mahin, 1998).

Canada does not have a national building or housing policy. The provinces and territories are responsible for designing and delivering housing policy and programs within their respective jurisdictions. Although many provinces have policies relating to greening new government funded buildings, they have not established policy related to green residential building. In fact, its municipalities that have led the way in setting policies and guidelines around green construction across the country (Wheeler, 2009).

While jurisdictions are not yet mandating green housing, some municipalities are instituting incentives for green housing and adopting guidelines and voluntary standards. For the most part, local governments have established guidelines and plans to promote

sustainability in communities and housing. Vancouver's recently launched Eco Density program is one such example. It is designed to create greater density throughout the city in a way that lowers environmental impact, ensures the existence of necessary physical and social amenities, and supports new and different housing types as a way to promote greater affordability. Many other municipalities have incorporated policy statements in their official community plan (OCP) to support smart growth planning principle or green design. Municipal bylaws and capital expenditures must align with the OCP (Craig, 2008).

Policy makers often wait until something undesirable or catastrophic happens before we implement controls and policy to resolve the issue. By considering the potential health risks, cumulative impact, potential organic waste removal issues and climatic site specific issues we can be proactive an attempt to avoid a potential undesirable or catastrophic situation. For example a lack of standard for green exteriors causes poor design resulting in an undesirable or catastrophic situation. The overarching issue is that there is virtually no policy and legislative direction in Sydney for green exteriors. There are a number of problems that combine to make developing principles for this a significant task. Firstly, it is unclear whether land use or building type influences design and planning principles for green exteriors. Furthermore, environmental and climatic factors need to be taken into consideration as identified by (Johnson, 2004).

The scale of implementation is also important and must be understood in the context of cumulative impact, incentives/barriers, green building codes, triple bottom line assessments, visual and micro climatic amenity. Australia is behind best practice as there

are no examples in Australia of local or state governments mandating the development of green exteriors. Additionally there are no examples of policy providing incentives in NSW. The key barrier in policy is the readiness of community to change as recognised by (Gleeson et al. 2005).

The exclusion from green building codes by way of lack of direct reference means that only biodiversity benefits can be recognised. This has significant implications as the codes are focused on the clean production and reduction in the use of energy of which however there is no attempt to recognise mitigation of heat which is produced by energy usage. This can be addressed by ensuring that policy contains facades, roofs and ground planes dealt with as a single landscape concept and the overall landscape benefit is assessed,(Gleeson et al., 2005).

2.6 Construction Cost on Development of Safe Sustainable Storey Buildings

Cost figures out prominently as a barrier to achieving sustainability safe storey buildings. In many instances, although cost differentials have not been thoroughly investigated by many researchers, developers are certain that anything other than 'business as usual' would be more expensive (Williams and Dair, 2006). Williams and Dair, (2006) further notes that most developers argue that meeting statutory obligations, imposed through planning requirements, such as archaeological investigations (which were required in three case studies), wildlife surveys, contributions to off-site highway provision, affordable housing and land remediation were already onerous, without extending their actions to 'optional' sustainability measures. Speculative developers point out that the cost of providing environmentally safe sustainable buildings and

developments is significantly higher than for standard schemes and most are usually not convinced there is a widespread demand for such buildings (Williams and Dair, 2006).

Financial incentives will also be necessary, to boost the interest of those people who will never be compelled by the environmental reasoning behind sustainable building, and also to even the playing field for those who are compelled. Until better savings recovery arrangements are worked out, incentives can also serve to lower first costs in cases where the developer, or investor, is not able to recoup future savings. Economic incentives can be used to promote voluntary action (e.g., conservation) where it might not occur otherwise. Tools include tax credits and rebates, as well as financial assistance, such as loans with favourable terms or outright grants. Respondents listed a number of economic strategies that have helped them incorporate sustainable practices into their projects. The most commonly cited strategies were utility incentives, such as inspections/audits or rebates for installing new, efficient equipment, which a respondent described as being “enormously effective in reducing demand” for gas, electricity, and water (Pickett, 2007).

Sustainable building rating systems not only educate owners about the environmental soundness of their homes or facilities, but they provide an indirect economic incentive by providing a marketing edge for building professionals who build structures that merit the higher ratings, because their buildings will sell for more (assuming that real estate brokers incorporate the rating system in their valuation of the sales price). Because of the higher building value and the return on investment gained through the future savings in utility bills (reflected in the rating level), applicants can often get larger loans than they would. Colorado’s E-Star program, designed with help

from the federal Department of Housing and Urban Development and the Federal Housing Administration, is a model rating/mortgage program, (Crawford, et al. 2009).

Despite the great interest in economic incentives, several respondents were “leery” of them, feeling that “green design should stand on its own.” A few respondents were concerned about the use of incentives that “perpetuate a false economy.” Instead, they would like to see “valuation...imposed...on externalities” and elimination of perverse disincentives. In other words, the view is that it would preferable to tax “bad” activities like non-renewable fuel use (to internalize their costs) or at least to stop subsidizing them, rather than to start subsidizing good things. For example, one respondent wrote: “Remove subsidies for polluting industries and the energy supply system we have today, to level the playing field for safe energy and environmental building” (Borrett, 2009).

2.8 Theoretical Framework

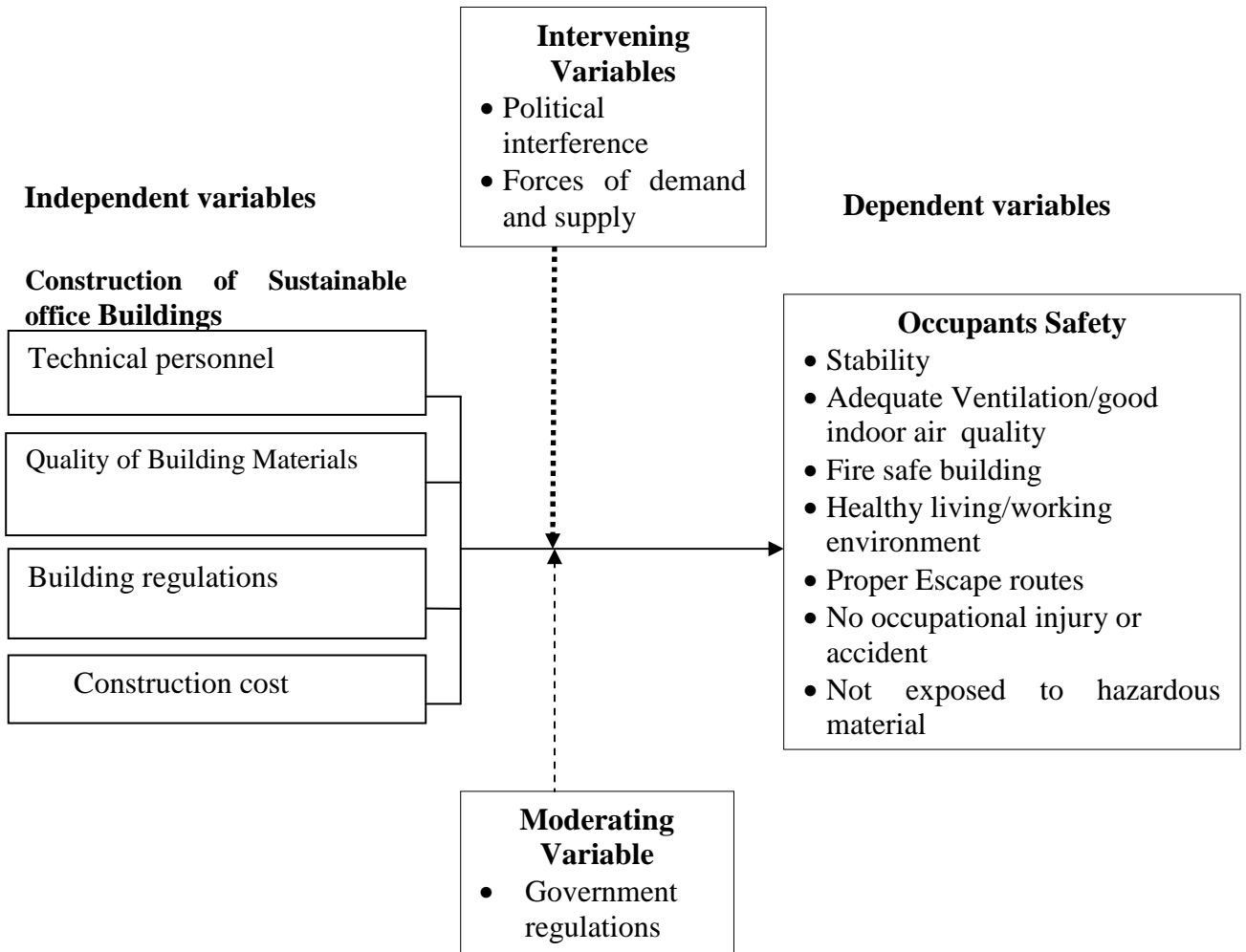
The current study adopted the theory of social translucence in Erickson and Kellogg (2000) argues that motivating desired behaviour requires more than making one’s behaviour visible to his or her social network. It identifies three properties; visibility, awareness, and accountability, of socially translucent systems, systems that support coherent behaviour in groups and communities by making participants and their activities visible to one another. The theory states that socially translucent systems first have to make socially significant information, such as one’s energy consumption or transport behaviour, visible to one’s social network. Once this information is visible, people may or may not become aware of this and may act upon it. For instance, they may

positively respond to a good act and thus reinforce it or may also become motivated to behave in the same manner.

Thirdly, this mutual awareness of each other behaviours eventually results into people feeling more accountable for their actions. Visibility refers to making one's behaviour (e.g. energy consumption) visible to others. In other words, eco-feedback interfaces need to visualize consumption behaviours within a house but also challenge family misbeliefs about what actions may result to energy savings. The theory of Social Translucence applies to this study because it relates to the objective areas the study is based. This theory is deemed relevant because the study focuses on social facets as key response strategies which include (education, stakeholder involvement, by-laws enforcement and financial incentives).

2.9 Conceptual Framework

Figure 1: Model indicating a relationship between the dependent and independent variables.



Source: Author (2013).

Figure 1: Conceptual framework

Depending on the nature of adoption and implementation of the independent variable (training, quality of building material, Building regulations and construction cost), it can either lead to safe sustainable building or the contrary. Furthermore, the relationship

between the variables can be interfered with by the intervening variables which might lead to non expected results.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter covers the methodology and procedures that were followed when carrying out the study. The purpose of this section was to provide a description of the research area or setting, an outline of the study population, sample size and sampling techniques, data collection instruments, data collection procedures and data analysis and presentation. Each of the sub-headings mentioned above is separately explained below.

3.2 Research Design

This study adopted a survey design based on a sample drawn from across the Eldoret Municipality. Survey design usually relates to the present state of affairs and involves an attempt to provide a snapshot of how things are at a specific time at which the data is collected (Frankel and Wallen, 2000). It is often characterized by the selection of random samples from large populations to obtain empirical knowledge of a contemporary nature (Saunders, Lewis and Thorn hill, 2009).

3.3 Study Area

The study was carried out in Eldoret Municipality in Uasin Gishu County, Kenya. It lies at an altitude of 2,085 metres above sea level and traverses latitude 00 31' North and longitude 35016' East. It is located about 312 km northwest of Nairobi on the main Kenya-Uganda highway. The town has since grown over years and has become one of the most important and fastest growing agricultural, commercial and industrial towns in

Kenya with an average growth rate of 7-8% per annum. Eldoret could be described as a river valley town, with land rising from the Sosiani River valley both northwards and southwards. It rises to 1800m above sea level in the extreme northwest and 2120m above sea level in the extreme southeast. The northern part is marked by a steep slope. Geologically, Eldoret falls under the tertiary volcanic period. The rocks are mainly of alkaline type including basalts, phonolites, nephelinites, trachytes, alkali rhyolites and their pyroclastial equivalents (Okalebo, 2009).

3.3 Target Population

Mugenda and Mugenda (1999) define a target population as a complete set of individuals, cases or objects with some common observable characteristics. The study targeted 402 respondents mainly the owners, supervisors, designer and contractors of the buildings within the Eldoret Municipality. The officials from Works Department in the Ministry of Lands, Housing and Urban Development as well as Eldoret Municipality planning Department were also targeted. These respondents were drawn from all the streets within Eldoret Town and other from the outskirts. The streets include; Uganda Road (34 buildings), Elijah Cheruiyot (4 buildings), Nandi Road (Buildings 15), Moi Street (2 building), Ronald Ngala (13 buildings), Oloo Street (9 buildings), Kenyatta Street (8 buildings) and Oginga Odinga (5 Buildings).

Table 3.3 Target Population

	Respondents	Target Population	Percent
1	owners	113	28%
2	Supervisors	151	37%
3	Designers	74	19%
4	Contractors	64	16%
		402	100%

Source: Ministry of Public works/ Eldoret Municipal Department of Planning

3.4 Sample size and Sampling Technique

The choice of the sample size depends on the level of confidence one needs to have in his data; it also depends on the type of analysis one is going to take and the size of the total population from which that sample is to be drawn. The sample size using non-probability sampling determines the accuracy of the sample. The study adopted the Morgan's Table to calculate the sample size. The sample size was found to be 201 respondents. The distribution of the respondents was as shown in the table 3.2.

Table 3.2 Sample size Distribution

	Respondents	Target Population	Calculation	Sample size
1	Owners	113	28% of 201	57
2	Supervisors	151	37% of 201	74
3	Designers	74	19% of 201	37
4	Contractors	64	16% of 201	33
		402		201

Source: Study 2013

The sample size for the owners was 57(28%) respondents while the supervisors were 74(37). The sample size of the designers was 37(19%) respondents while the contractors were 33(16%). The study used purposive random sampling to select the owners of the buildings while the supervisors, the designers and contractors were selected by simple random sampling.

3.5 Data collection Instruments

The data collection instruments are tools to collect information from the intended target population (sample size). The data collection instrument that was used in this study was developed by the researcher. The study used the questionnaire and interview schedule in data collection. A total of 201 questionnaires were issued to the respondents. The study interviewed 2 ministry officials and 2 municipality officials. The questionnaire is deemed as a method that collects a lot of information over a short period of time.

3.5.1 Pilot Study

In order to ascertain validity of the research instruments, the researcher piloted the instruments by distributing twenty (20) questionnaires to other respondents in Iten town, which is not part of the areas sampled. The results of the piloted questionnaires enabled the researcher to determine the consistency of responses to be made by respondents and adjust the items accordingly by revising the document.

3.5.2 Validity

Validity of instruments is a measure of how well an instrument measures what it is supposed to measure (Kombo and Tromp, 2006). It is the accuracy and meaningfulness

of inferences, which are based on research results. It means the agreement between value of measurements and its true value. Validity is quantified by comparing measurements with values that are as close to the true values as possible. Poor validity also degrades the precision of a single measurement, and it reduces the ability to characterize relationships between variables in descriptive studies. The researcher ensured content validity of the questionnaire by giving to the supervisor and other research experts to ensure that the questions test or measure what they are supposed to measure.

3.5.3 Reliability

Reliability is the measure of the degree to which a research yields consistent results or data after repeated trials. It is the degree of consistency that the research instruments or procedures demonstrate. Reliability is the measure of how consistent the results from a test are. Creswell (2000) poses a question to researchers that if you administer a test to a subject twice, do you get the same score on the second administration as you did on the first? The reliability of test is the answer to this question (Kombo and Tromp, 2006). The reliability of data collection instruments was determined from the pilot study where the researcher administered the research instruments in Iten town. The research administered questionnaires to the same respondents twice. The Cronbach's coefficient alpha was applied on the results obtained to determine how items correlate among them in the same instrument. Cronbach's coefficient Alpha of more than 0.7 will be taken as the cut off value for being acceptable which will enhance the identification of the dispensable variables and deleted variables.

3.6. Data Collection Procedure

After seeking the consent of the University of Nairobi and the supervisors, the researcher visited the ministry officials and municipality planning officials to introduce to seek their consent on collecting data. In collecting data, the researcher visited the respondents from time to time within a span of one week to two weeks to allow time for the respondents to fill in the questionnaires. Also, the researcher ensured that she had explained the purpose of the visit to the respondents. This assured the respondents of their confidentiality of any information they gave.

3.7 Data Analysis procedure

The data was analyzed, using descriptive statistics, frequency tables and percentages. Descriptive statistics used included frequencies and percentages. Another method that was used includes; cross tabulation process, an essential technique in tabulating frequencies and occurrences of some variables when analyzing qualitative data, especially from observation and interviews.

3.8 Ethical Considerations

Kombo and Tromp (2006) note that researchers whose subjects are people or animals must consider the conduct of their research, and give attention to the ethical issues associated with carrying out their research. This study dealt with people as respondents. Therefore, the researcher assured the respondents of confidentiality. The researcher considered the fact that participation in research is voluntary. This is why the researcher took time to explain to the respondents the importance of the study and

therefore request the respondents to participate in the study by giving information relevant for the study. To establish good working relationship with the participants, the researcher endeavoured to develop a rapport with them.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS AND INTERPRETATION

4.1 Introduction

This chapter carries out presentation, analysis interpretation and discussions of the findings. This chapter entails two parts. The first part covers the demographic information of the respondents while is organized according to the objectives of the study.

4.2 Response Rate

Two hundred and one questionnaires were sent out for data collection and one hundred and ninety eight were returned by the respondents for analysis. The return rate therefore was very good at 98.01% with only 1.98% not returned.

4.3 Demographics Information

The study first sought to investigate the demographic data of the respondents participating in the study. This was sought because it would help to find out if the sample was really representative of the population. The study would use such findings to gauge the reliability of the data achieved.

4.3.1 Respondents by Gender

The respondents were asked to indicate their gender. This aimed at finding out if the selected sample was representative of the population. The study found out that

112(56.6%) respondents were male while 86(43.4%) were female respondents. It was also noted that 58% of the owners were female. The study findings were presented on the Table 4.1.

Table 4.1: Gender of the respondents

	Respondents by Gender		
	Male	Female	Total
Owners	32	23	55
Supervisors	48	26	74
Designers	17	19	36
Contractors	15	18	33
Total	112	86	198

Source: Study 2013

The results reveal that 42% of the males were supervisors while 13% were contractors. The findings indicated that both male and female respondents participated in the study with male respondents being slightly more than the female respondents. This implies both female and male are involved in the construction industry.

4.3.2 Respondents' Age

The study further sought to investigate the ages of the respondents that participated in the study. The research findings were found to indicate that 96(48.5%) respondents were 31-50 years old while 62(31.3%) others were 20-30 years old. It was also found out that 32(16.2%) respondents were above 50 years old with other 8(4.0%) respondents being below 20 years old. It was further noted that most of the respondents on every

occupation were aged between 21 and 50 years. The respondents were sought for this and the findings presented on the table 4.2.

Table 4.2 Age of the respondents

	Age of the respondents				Total
	Below 20	21-30	31-50	Above 50	
Owners	0	6	41	8	55
Supervisors	6	1	49	18	74
Designers	1	32	2	1	36
Contractors	1	23	4	5	33
Total	8	62	96	32	198

Source: Study 2013

It was found necessary to conclude that the respondents were of all ages, majority of them being between 30 and 50 years old. The result shows that Eldoret Municipality has people of all the ages represented in all the occupations. These findings were in agreement with the findings from the interview given to the owners of the buildings. One of the ministry officials said;

“...Eldoret is a metropolitan town and has all the tribes, genders and ages represented almost on every street and in every building”

4.3.3 Education level of Respondents

This study further investigated the educational level of the respondents since it was also found necessary in finding out the level of accuracy of the findings obtained. The respondents were asked to indicate their level of education. The study found out that all respondents had secondary education and over. The findings indicated that 97(49.0%)

had college education and 87(43.9%) respondents indicate that they had university education. There were 14(7.1%) respondents with secondary education. Study findings were presented in table 4.3.

Table 4.3 Education Level

	Education Level			Total
	Secondary	College	University	
Owners	3	22	30	55
Supervisors	8	26	40	74
Designers	2	27	7	36
Contractors	1	22	10	33
Total	14	97	87	198

Source: Study 2013

The study found out that majority of the respondents had more than college education. In all the three categories the majority of the respondents had college education and university. This result implies that the respondents were competent to be included in the study since they were deemed to literate. The participation of such members who are educated beyond secondary level means that the tool used for data collection, questionnaire, was appropriate.

4.4 Technical Personnel and Construction of Safe Storey Building

The study in line with the first objective sought to find out the effect of technical personnel on the construction of safe sustainable building in Eldoret Municipality. To accomplish this, the respondents were asked to indicate whether they agreed or disagreed with statement particular statements.

4.4. 1 Architectural works

The study sought to establish whether the architects of the buildings competently design the storey building. The study had 51% of the respondents approving the ventilation status while 35% approved the lighting in the buildings. Only 13% felt that the office space was standard. It was a common trend in all occupation where the respondents held the opinion that most of the buildings are not user friendly in terms of space. The study findings were presented as shown in the table 4.5.

Table 4.5: Architectural works and construction of safer storey buildings

	Architectural works approval			Total
	spacious	ventilation	Lighting	
Owners	12	25	18	55
Supervisors	2	40	32	74
Designers	6	21	9	36
Contractors	6	15	12	33
Total	26	101	71	198

Source: Study 2013

These trends imply that the architects of most building did not provide for spacious offices as well as put into account the user needs. These could mean that most of the buildings have permanent walls separating the offices and pose a challenge when clients want to establish more spacious offices. Most of the buildings are likely to have lower ration of basic utility services like toilets which exert pressure on the existing ones hence breakdowns are witnessed regularly. The most affected clients are those with businesses that require halls for their operation like in the case of financial institutions, supermarkets and learning institutions.

4.4.2 Strength of the buildings

The study sought to establish whether the structural engineering works on the buildings guarantee safe stable buildings. The results indicated that 72% of the respondents agreed that their buildings pillars were strong enough to sustain the structure. Specifically, 70% of male agreed, while on the other hand, 75% of the female respondents agreed that the pillars were strong and stable. Nevertheless, 28% of the respondents approved the status of the beams as evidence of strength in most of the buildings. The study findings were presented as shown in the table 4.6

Table 4.6 Strength of the buildings

	Strength of the building		
	Pillars	Beams	Total
Owners	38	17	55
Supervisors	55	19	74
Designers	27	9	36
Contractors	24	9	33
Total	144	54	198

Source: Study 2013

It was evident that most of the respondents agreed that structural engineers do their work competently to ensure stable, strong building without cracks in the walls. This response is an indicator of the state of the buildings which in Eldoret Municipality where there no records for falling structures. This scenario does not fully mean that all the buildings in the Municipality are strong; the reason of not fall could be that there has not been pressure exerted on the structures following the urban population influx. Another reason could be that there have never been major blasts in town to shake up the buildings

and test their stability. This can be inferred to mean that with a lot of reservation it can be concluded that the building structures in Eldoret Municipality are safe in terms of stability.

4.4.3 Electrical Engineers works

The study had to establish another technical personnel aspect in relation to the electrical engineers' works in the buildings. The results revealed that 79% of the respondents agreed that there have been very minimal cases of short circuits within the buildings. Nevertheless there were 20% of the respondents who held a contrary opinion and recorded that power overload was very minimal. It was evident that 2% of the respondents were of the opinion that short circuits and power overload were common. The results are shown in table 4.7.

Table 4.7 Electrical Engineers works

	Electrical Engineers works			Total
	Short circuits	Power overload	Both are common	
Owners	34	20	1	55
Supervisors	38	34	2	74
Designers	24	12	0	36
Contractors	6	27	0	33
Total	102	93	3	198

Source: Study 2013

4.4.4 Communication within the building and business safety

The study examined the communication aspect of safety in the buildings as designed by communication engineers. The results revealed that 54% of the respondents agreed that communication within the building was clear and enhanced business. However there were 46% of the respondents who argued that their business communication was not very viable for business. There was the same trend in all the age sets. The results are as shown in table 4.8.

Table 4.8 Communication within the building and business safety

Communication within the building is clear for enhanced business environment				
Age	Yes	No	Total	
Below 20	5	3	8	
21-30	32	30	62	
31-50	56	40	96	
Above 50	15	17	32	
Total	108	90	198	

Source: Study 2013

Good business environment is dependent on a clear and convenient communication network. The results in table 4.8 reveal that there could be a mixed reaction owing to the fact that some of the buildings do not have a good communication network. There could be some which have little or no access to the mobile communication network services like Safaricom, Airtel or Orange. This scenario will deprive both the clients and business people of some services that could leverage their businesses. Some building do not have plans for putting up advertisements of the business within hence end up with overcrowded advertisement board from which no

much information can be retrieved. The communication engineer needs to provide for enough advertisement space to ensure every enterprise is viewed without bias or confusion.

4.4.5 Mechanical Building Services

Mechanical services in most buildings play a crucial role and are installed by the technical personnel of the building. The results reveal that 84% of the respondents agreed that most common problem in buildings was leaking pipes. Only 15% of the respondents cited faulty lifts as a common problem. The trend was common to supervisors, owners, designers and contractors where the majority disagreed that the mechanical services were excellent.

Table 4.9 Mechanical Building Services

Mechanical building Services			
	Faulty lifts	Leaking pipes	Total
Owners	4	51	55
Supervisors	18	56	74
Designers	6	30	36
Contractors	2	31	33
Total	30	168	198

Source: Study 2013

From Table 4.9, the study established that majority of the respondents feel that the mechanical services are not very well established. This could imply that there are many reported failures of lifts or plumbing systems within the buildings. This could be strengthened by the response from one of the ministry officials who alluded;

“.....some of the common failures are attributed to the engineers especially where you find the water overflowing, exposed piped water, leaking valves and poor ventilation that leads the buildings to be stuffy all the time...”

4.4.6 Civil engineers works

It was necessary to establish the efficacy of civil engineers works. The respondents were asked to comment on whether there is storm water, were a common problem. The results reveal that 73% of the respondent agreed absence of fire assembly points is a major challenge. Only 17% were of the opinion that storm water was a major problem. The results were recorded in the table 4.10

Table 4.10: Civil engineers works

Civil engineers works			
	Absence Fire assembly points	Poor Storm water Drainage	Total
Owners	37	18	55
Supervisors	58	16	74
Designers	29	7	36
Contractors	21	12	33
Total	145	53	198

Source: Study 2013

The results reveal that in case of fire, there is likely to be a confusion which might lead to avoidable disasters. The results in table 4.10 further reveal that there is a problem with the drainage system within the Eldoret municipality. The problem threatens safety of

the office occupants in the sense that they can find all their offices stormed with water hence mutilate the documents as well as discourage clients from visiting. It can further be inferred that the civil works in the construction industry could be a job of the inexperienced hand or merely protégés who are on job training at the expense of the occupants' safety.

4.5 Construction Material and safety of occupants

4.5.1 Inspection of construction materials

This study further investigated the influence of quality of building materials on construction of safe sustainable storey buildings. The study revealed that 38% of the respondents agreed while 62% disagreed. Apparently, supervisors, owners and contractors appeared to uniformly disagree to this statement. The study findings presented on the Tables 4.11

Table 4.11: Inspection of construction materials

Material to be used in construction are inspected prior to construction of storey buildings			
	Yes	No	Total
Owners	37	18	55
Supervisors	58	16	74
Designers	29	7	36
Contractors	21	12	33
Total	78	120	198

Source: Study 2013

In Table 4.11, Most of the owners seem not to agree that the materials are inspected. This result shows that even though there is the regulations that require all the

materials to be inspected there seem to be some loophole through which the materials are not inspected. Nevertheless, there are some respondents few who agreed that there is inspection. This could be attributed to the approvals on paper while the real measure on the construction site is different. This could be true owing to the fact that the contractors do not parade all their materials for inspection at the building site in the onset of the works; the materials are delivered subsequently after the launch of the works.

4.5.2 Change of approved material specification

The study had to establish if the approved building materials are sometimes changed by the contractors without notification of relevant authorities. It appeared that 67% of the respondents agreed, while 33% disagreed. Consequently, owners, supervisors and contractors agreed with contractors recording the highest of 61%. The study findings presented on the table 4.12

Table 4.12: Change of approved material specification

Approved building materials are sometimes changed by the contractors without notification of relevant authorities			
	Yes	No	Total
Owners	37	18	55
Supervisors	58	16	74
Designers	29	7	36
Contractors	21	12	33
Total	124	74	198

Source: Study 2013

It was evident that majority of the respondents agreed that the approved building materials are sometimes changed by the contractors without notification of relevant authorities. It was evident that the contractors and owners agreed that changes are common, a view that shows some kind of honesty owing to the fact that they integral in the matter. This result implies that there are cases where the approved materials are not actually used in the construction. In the interviews with the owners of the buildings study found out that this was a common scenario and was attributed to the lack of trust by the contractors, the forces of demand and supply and corruption within the government officers in charge of the approvals involved. It was further found out from the municipality officials interviews that some of the changes are necessary and also that land value will determine the likelihood to adhere to the stipulated measures of materials.

4.5.3 Sourcing of construction materials

A cross tabulation of whether the contractors are mostly compelled to source the building materials locally was established. It was apparent that 37% agreed, while 60 disagreed to the idea. Consequently, most of the owners disagreed. Most of the supervisors, accounting for 50.9% of the respondents were undecided on the matter. The study findings presented on the Table 4.13;

Table 4.13: Sourcing of construction materials

Contractors are mostly compelled to source the building materials locally			
	Yes	No	Total
Owners	37	18	55
Supervisors	58	16	74
Designers	29	7	36
Contractors	21	12	33
Total	97	101	198

Source: Study 2013

In table 4.13, it can be concluded that the contractors are not compelled at all to source materials from the locals. Any low quality materials bought locally are done at the contractors' discretion.

4.5.4 Purchase of cheap low quality Materials

From Table 4.14 it was evident that 48% of respondents agreed that the construction industry faces great challenges in high cost of building materials hence cheap less value material opted for. Seemingly, it was also noted that 52% were of a contrary opinion on the issue.

Table 4.14 Purchase of cheap low quality Materials

High cost of building materials has led to purchase of cheap but less value material			
Age	Yes	No	Total
Below 20	7	1	8
21-30	34	28	62
31-50	39	57	96
Above 50	17	15	32
Total	97	101	198

Source: Study 2013

From the study above, it is apparent that construction industry faces great challenges in high cost of building materials hence cheap less value material opted for. High cost building materials hinders affordability thus paving way for acquisition of cheap materials that otherwise might cause havoc.

4.6 Building regulations and construction of safe storey buildings

This study, as required by the third objective of study, investigated the extent to which enforcement of building regulations influence development of sustainable building in Eldoret Municipality. The respondents were sought for how they agreed or disagreed with statements about the concerned topic and the findings were presented.

4.6.1 Implementation of building codes

The study asked the respondents if building codes were usually followed to the letter in construction and (73%) respondents disagreed while (27%) of the respondents being observed to agree. In both male and females, there was a high level of disagreement.

Table 4.15 Implementation of building codes

Building codes are usually followed to the latter by the contractors				
	Gender	Yes	No	Total
	Male	40	91	131
	Female	14	53	67
Total		54	53	198

Source: Study 2013

The study concluded that majority of the respondents disagreed with this. It was evident also that there were more owners than contractors that agreed to this issue. This result confirmed the results from the interviews where the owners and ministry officials complained that the main cause of unsafe buildings was lack of adherence to the building code. This can be attributed to corruption or simply negligence of the law by the contractors.

4.6.2 Reliability of building regulations

As shown in table 4.16, the study further asked the respondents if all supervisors in the offices in the building are safer due to the regulations. The results show that 78% of the respondents disagreed with this notion. It was clear that 81% of the supervisors disagreed while only 79% of the owners and 68% of the contractors disagreed to the contention.

Table 4.16 Reliability of building regulations

Building regulations has assured the safety confidence of office occupants				
	Gender	Yes	No	Total
	Male	14	66	80
	Female	24	94	118
Total		38	160	198

Source: Study 2013

This implies that the respondents had no confidence in the regulation systems that were meant to streamline the construction of the storey buildings.

4.6.3 Construction material audits by the government

The respondents were further asked if the inspectors conducted audits to check on the suitability of the proposed building works and 53% of the respondents agreed while there were other 47% of the respondents disagreed.

Table 4.18: Construction material audits by the government

Inspectors conduct audits to check on the suitability of the proposed building works			
	Yes	No	Total
Owners	27	28	55
Supervisors	48	26	74
Designers	25	11	36
Contractors	11	22	33
Total	111	87	198

Source: Study 2013

The study showed that there are audits that are conducted to check on the suitability of the proposed building works.

4.6.4 Continuous monitoring and evaluation of construction materials

In Table 4.19, the respondents were further asked if continuous monitoring and evaluation was conducted by local authorities to ensure that buildings were constructed as per the standards established and from the findings, 50% of the respondents agreed and 41% others disagreed with the statement.

Table 4.19: Continuous monitoring and evaluation of construction materials

Continuous monitoring and evaluation is conducted by local authorities to ensure that buildings are constructed as per the standards established

Age	Yes	No	Total
Below 20	0	8	8
21-30	33	29	62
31-50	58	38	96
Above 50	13	19	32
Total	83	76	198

Source: Study 2013

These results imply that the stakeholders are likely to complying with the standards established. Nevertheless, there are still some contractors who comply with set standards that aim to ensure sustainable buildings.

4.6.4 Disaster preparedness by policy makers

The study went on to investigate if policy makers often waited until something undesirable happened before implementing controls and policy to resolve the issue and the results indicated that 80% of the respondents agreed while 20% had a contrary opinion. It was noted that in all the occupations the more than half of respondents agreed that policy makers often wait until something undesirable happens before implementing controls and policy to resolve the issue.

Table 4.20: Disaster preparedness by policy makers

Policy makers often wait for disasters so as to take action			
	Yes	No	Total
Owners	42	13	55
Supervisors	63	11	74
Designers	29	7	36
Contractors	26	7	33
Total	160	38	198

Source: Study 2013

The study concluded that majority of the respondents agreed that the policy makers are more reactive than proactive on the matters of construction.

4.6.5 Installation of fire protection equipments

From table 4.21, the study went on to investigate if there were fire protection equipments in the buildings and the findings showed that 55% of the respondents agreed while 45% of the respondents disagreed.

Table 4.21: Installation of fire protection equipments

Working Fire protection equipment is present in most storey buildings in Eldoret Municipality

	Yes	No	Total
Owners	31	24	55
Supervisors	48	26	74
Designers	19	17	36
Contractors	11	22	33
Total	109	89	198

Source: Study 2013

The findings revealed that not all buildings are installed with fire protection equipment.

4.7 Construction cost and development of safe sustainable storey buildings

The study also sought to find out the extent to which cost of construction influenced construction of safe sustainable building in Eldoret Municipality. The study required the respondents to indicate how they agreed or disagreed with statements about the same and the findings were presented.

4.7.1 Types of construction costs

Most of the respondents agreed that the high cost discourage construction of safer buildings. The results in table 4.22 reveal that 79% of the respondents agree that high costs discourage safer building construction.

Table 4.22 Effect of types of construction cost

The high costs of construction discourage development of safer storey buildings			
Type of costs	Yes	No	Total
Land costs	38	10	48
Material costs	60	12	72
Labour costs	21	8	29
Legal Fees	18	5	23
Overhead costs	20	6	26
Total	157	41	198

Source: Study 2013

The high costs are likely to have effect on the construction of sustainable buildings. The result was also echoed in the interviews by the owners of the buildings who believe some of the unsafe buildings are as a result of high cost of full compliance. One of the owners alluded;

“..The high costs of building a structure do not allow us to put into account so many things except for the basic measures because most of the materials are not produced locally and the expertise in the industry is very expensive...”

4.7.2 License Subsidies Incentives

When asked whether the municipality has instituted license subsidies incentives for safer building, most of the respondents accounting for about 83% disagreed. Only 17% held the opinion that the municipality has instituted such an incentive. The 78% of the supervisors disagreed while 82% and 81% of the owners and contractors respectively disagreed.

Table 4.23: License Subsidies Incentives

The municipality has instituted license subsidies incentives for safer storey buildings			
	Yes	No	Total
Owners	9	46	55
Supervisors	7	67	74
Designers	9	27	36
Contractors	1	32	33
Total	26	172	198

Source: Study (2013)

The results in Table 4.23 imply the type of the respondents in the study did not have any effect on their opinion. The majority were of the opinion that the municipality is not doing much in terms of giving incentives on licenses so as to motivate investors to construct safe sustainable buildings. It can further be inferred to imply that any initiatives for safer sustainable buildings within the municipality are from individual efforts. The study concluded that there are no license subsidies that could act as incentive for contractors to invest in safer buildings.

4.7.3 Financial institutions role in safer storey buildings construction

The respondents sought to know whether financial institutions contribute to the construction of safer buildings. The results show that 58% of the respondents disagreed to this contention while 42% agreed that the financial institution insist on safe building prior to financing construction projects. More males disagree to this contention as they were rated at 50% disagreement and the female were rated at 36%.

Table 4.24 Financial institutions role in safer storey building construction

Financial institutions insist on safe storey building plans before granting loans to investors

Gender	Yes	No	Total
Male	35	77	112
Female	26	39	86
Total	82	116	198

Source: Study 2013

This shows that the banks do not incorporate the issues of safer sustainable storey buildings as part of the requirements before issuance of loans even though they are likely to boost up the efforts towards safe sustainable storey buildings that will enhance occupant safety.

4.7.4 Preference of long term benefits of safer storey buildings

In Table 4.25 It was evident that very many respondents 85% agreed that investors have become less cost conscious at the after understanding that sustainable building pay in the long run as opposed to the short term. It was also evident that most of the supervisors who participated in the research agreed over the same. The same trend was realized in the owners and contractors where 90% and 79% agreed respectively.

Table 4.25: Preference of long term benefits of safer building

Investors prefer long term benefits of the safer sustainable buildings			
	Yes	No	Total
Owners	45	10	55
Supervisors	64	10	74
Designers	34	2	36
Contractors	26	7	33
Total	169	29	198

Source: Study 2013

The results show a good trend in terms of the future of sustainable building. When the landlords recognize the long term benefits of sustainable buildings, there is a likelihood that safe sustainable building will be built in the Municipality with minimal compulsion from the authorities. This is a positive trend that will ensure safer sustainable buildings are constructed.

4.7.5 Cost of installation of safety appliances

The study sought to get the views of the respondents on the installation of safety appliances (fire extinguishers) and provisions of emergency exits, ramps, fire escape staircases. The results showed that 71% of the respondents agreed that installations of the safety appliances and provisions of escape routes was a very costly activity. It further clear that 29% of the respondents were of a contrary opinion.

Table 4.6: Cost of installation of safety appliances

installation of safety appliances (fire extinguishers) and provisions (emergency exits) is a very costly activity

Education Level	Yes	No	Total
secondary education	1	13	14
college	72	25	97
university	68	19	87
Total	141	57	198

Source: Study 2013

The result implies that a clear budget should be included in the construction costs as a way of ensuring the installation of these safety appliances is factored in the main costs.

CHAPTER FIVE
SUMMARY OF FINDINGS, DISCUSSIONS, CONCLUSIONS AND
RECOMMENDATIONS

5.1 Introduction

This chapter focuses on the summary of the study findings, conclusions and recommendations. Suggestions for further research are also enumerated. The study set out to investigate effect of construction of sustainable storey office building on occupants' safety in Eldoret Municipality.

5.2 Summary of Findings.

This section presents a discussion of the findings of this study. This study was carried out at Eldoret Municipality. The respondents' personal data was sought and it was found out that the stakeholders in the construction are of both male and female gender. The findings further indicate that most of them are of their ages between 30 and 50 years. Most of these stakeholders are occupants. The findings indicate that majority of them have college education and university education. The researcher concluded that majority of them are well learned individual.

5.2.1 Technical Personnel and Construction of Safe storey Buildings

The study in line with the first objective sought to find out the effect of technical personnel on the construction of safe sustainable building in Eldoret Municipality. To accomplish this, the respondents were asked to indicate whether they agreed or disagreed with statement particular statements.

The study sought to establish whether the architects of the buildings competently design the storey building. The study had half of the respondents approving the ventilation status a few approved the lighting in the buildings. These trends imply that the architects of most building did not provide for spacious offices as well as put into account the user needs. These could mean that most of the buildings have permanent walls separating the offices and pose a challenge when clients want to establish more spacious offices. Most of the buildings are likely to have lower ration of basic utility services like toilets which exert pressure on the existing ones hence breakdowns are witnessed regularly. The most affected clients are those with businesses that require halls for their operation like in the case of financial institutions, supermarkets and learning institutions.

The study sought to establish whether the structural engineering works on the buildings guarantee safe stable buildings. The results indicated that majority of the respondents agreed that their buildings pillars were strong enough to sustain the structure. Nevertheless, few of the respondents approved the status of the beams as evidence of strength in most of the buildings. It was evident that most of the respondents agreed that structural engineers do their work competently to ensure stable, strong building without cracks in the walls. This response is an indicator of the state of the buildings which in Eldoret Municipality where there no records for falling structures. This scenario does not fully mean that all the buildings in the Municipality are strong; the reason of not fall could be that there has not been pressure exerted on the structures following the urban population influx.

The study had to establish another technical personnel aspect in relation to the electrical engineers' works in the buildings. The results revealed that most of the

respondents agreed that there have been very minimal cases of short circuits within the buildings. Nevertheless there were few of the respondents who held a contrary opinion and recorded that power overload was very minimal. It was evident that very few of the respondents were of the opinion that short circuits and power overload were common.

Mechanical services in most buildings play a crucial role and are installed by the technical personnel of the building. The results reveal that majority of the respondents agreed that most common problem in buildings was leaking pipes. Only few of the respondents cited faulty lifts as a common problem. The trend was common to supervisors, owners, designers and contractors where the majority disagreed that the mechanical services were excellent.

The study established that majority of the respondents feel that the mechanical services are not very well established. This could imply that there are many reported failures of lifts or plumbing systems within the buildings. The results reveal that in case of fire, there is likely to be a confusion which might lead to avoidable disasters. The results further revealed that there is a problem with the drainage system within the Eldoret municipality. The problem threatens safety of the office occupants in the sense that they can find all their offices stormed with water hence mutilate the documents as well as discourage clients from visiting. It can further be inferred that the civil works in the construction industry could be a job of the inexperienced hand or merely protégés who are on job training at the expense of the occupants' safety.

5.2.2 Quality of Building Materials and Construction of Safe Storey Buildings

The results revealed that half of the respondents felt that the construction materials were not inspected prior to construction of storey buildings while a few agreed that the materials were inspected. Most of the owners seem not to agree that the materials are inspected. This result shows that even though there is the regulations that require all the materials to be inspected there seem to be some loophole through which the materials are not inspected. Nevertheless, there are some respondents who agreed that there is inspection. This could be attributed to the approvals on paper while the real measure on the construction site is different. This could be true owing to the fact that the contractors do not parade all their materials for inspection at the building site in the onset of the works; the materials are delivered subsequently after the launch of the works.

The study sought to establish if the approved building materials are sometimes changed by the contractors without notification of relevant authorities. It appeared that more than half of the respondents agreed. Consequently, owners, supervisors and contractors agreed with contractors recording the highest of level of agreement. It was evident that the contractors and owners agreed that changes are common, a view that shows some kind of honesty owing to the fact that they integral in the matter. This result implies that there are cases where the approved materials are not actually used in the construction. In the interviews with the owners of the buildings study found out that this was a common scenario and was attributed to the lack of trust by the contractors, the forces of demand and supply and corruption within the government officers in charge of the approvals involved. It was further found out from the municipality officials

interviews that some of the changes are necessary and also that land value will determine the likelihood to adhere to the stipulated measures of materials.

It was evident that few of respondents agreed that the construction industry faces great challenges in high cost of building materials hence cheap less value material opted for. From the study above, it is apparent that construction industry faces great challenges in high cost of building materials hence cheap less value material opted for as supported by more than half of the contractors. High cost of building materials hinders affordability thus paving way for acquisition of cheap materials that otherwise might cause havoc.

5.2.3 Building Regulations and Construction of Safe Storey Buildings

This study, as required by the third objective of study, investigated the extent to which enforcement of building regulations influence development of sustainable building in Eldoret Municipality. The respondents were sought for how they agreed or disagreed with statements about the concerned topic and the findings were presented. The study asked the respondents if building codes were usually followed to the letter in construction and majority of the respondents disagreed. It was evident also that there were more owners than contractors that agreed to this issue. This result confirmed the results from the interviews where the owners and ministry officials complained that the main cause of unsafe buildings was lack of adherence to the building code. This can be attributed to corruption or simply negligence of the law by the contractors.

The study further asked the respondents if all occupants in the offices in the building are safer due to the regulations. The results show that majority of the respondents disagreed with this notion. This implies that the respondents had no

confidence in the regulation systems that were meant to streamline the construction of the storey buildings.

The respondents were further asked if the inspectors conducted audits to check on the suitability of the proposed building works and half of the respondents agreed. This showed that there are audits that are conducted to check on the suitability of the proposed building works. The study went on to investigate if policy makers often waited until something undesirable happened before implementing controls and policy to resolve the issue and the results indicated that almost all of the respondents agreed. It was noted that in all the streets the more than half of respondents agreed that policy makers often wait until something undesirable happens before implementing controls and policy to resolve the issue. The study investigated if there were fire protection equipments in the buildings and the findings showed that half of the respondents agreed.

5.2.4 Construction Cost and construction of Safe Storey Buildings

The study also sought to find out the extent to which cost of construction influenced construction of safe sustainable building in Eldoret Municipality. The study required the respondents to indicate how they agreed or disagreed with statements about the same and the findings were presented.

Most of the respondents agreed that the high cost discourage construction of safer buildings. The results in reveal that majority of the respondents agree that high costs discourage safe storey building construction. The high costs are likely to have effect on the construction of sustainable buildings. The result was also echoed in the interviews by

the owners of the buildings who believe some of the unsafe storey buildings are as a result of high cost of full compliance.

When asked whether the municipality has instituted license subsidies incentives for safe storey building, most of the respondents disagreed. The majority were of the opinion that the municipality is not doing much in terms of giving incentives on licenses so as to motivate investors to construct safe sustainable storey buildings. It can further be inferred to imply that any initiatives for safe sustainable storey buildings within the municipality are from individual efforts. The study concluded that there are no license subsidies that could act as incentive for contractors to invest in safe storey buildings.

The study sought to know whether financial institutions contribute to the construction of safe storey buildings. The results show that some of the respondents disagreed to this contention while others agreed that the financial institution insist on safe storey building prior to financing construction projects. This shows that the banks do not incorporate the issues of safe sustainable storey buildings as part of the requirements before issuance of loans even though they are likely to boost up the efforts towards safe sustainable storey buildings that will enhance occupant's safety.

It was evident that most of the respondents agreed that investors have become less cost conscious after understanding that sustainable storey building pay in the long run as opposed to the short term. It was also evident that most of the supervisors who participated in the research agreed over the same. The results show a good trend in terms of the future of sustainable storey building. When the landlords recognize the long term benefits of sustainable storey buildings, there is a likelihood that safe sustainable storey building will be built in the Municipality with minimal compulsion from the

authorities. This is a positive trend that will ensure safer sustainable storey buildings are constructed.

5.3 Discussion of Findings

Technical personnel in any field play a crucial role in ensuring the best standards are observed in any project. The architectural works were found to be effective through responses that were positive. Most of the respondents were comfortable with ventilation and lighting in their buildings. Nevertheless it was found that most of the office spaces are small in size. Structural engineering activities aim at achieving safe stable buildings. Most of the respondents agreed that structural engineers do their work competently to ensure stable, strong building without cracks in the walls. This response is an indicator of the state of the buildings which in Eldoret Municipality where there no records for falling structures. This scenario does not fully mean that all the buildings in the Municipality are strong; the reason of not fall could be that there has not been pressure exerted on the structures following the urban population influx. The results revealed that most of the respondents agreed that there have been very minimal cases of short circuits within the buildings but some cases of power overload was very minimal. Therefore, knowledge technical personnel will help implement policy and regulations and also to make their own informed decisions (Telegan, 2005)

The results revealed that most of the respondents felt that the construction materials were not inspected prior to construction of storey buildings. Most of the owners seem not to agree that the materials are inspected. This result shows that even though there is the regulations that require all the materials to be inspected there seem to be some loophole

through which the materials are not inspected. Nevertheless, there are some respondents who agreed that there is inspection. This could be attributed to the approvals on paper while the real measure on the construction site is different. This could be true owing to the fact that the contractors do not parade all their materials for inspection at the building site in the onset of the works; the materials are delivered subsequently after the launch of the works. Yet the building codes help facilitate safer buildings by requiring minimum standards for buildings, including foundation, roofing, plumbing, electrical, and other specifications for safety and sanitation (Friedman, Harris, and Linderman, 2004).

The study sought to establish if the approved building materials are sometimes changed by the contractors without notification of relevant authorities. It appeared that more than half of the respondents agreed. This result implies that there are cases where the approved materials are not actually used in the construction. In the interviews with the owners of the buildings study found out that this was a common scenario and was attributed to the lack of trust by the contractors, the forces of demand and supply and corruption within the government officers in charge of the approvals involved. It was further found out from the municipality officials interviews that some of the changes are necessary and also that land value will determine the likelihood to adhere to the stipulated measures of materials. It was apparent that construction industry faces great challenges in high cost of building materials hence cheap less value material opted for as supported by more than half of the contractors. High cost of building materials hinders affordability thus paving way for acquisition of cheap materials that otherwise might cause havoc.

This result confirmed the results from the interviews where the owners and ministry officials complained that the main cause of unsafe buildings was lack of

adherence to the building code. This can be attributed to corruption or simply negligence of the law by the contractors. The study further asked the respondents if all occupants in the offices in the building are safer due to the regulations. The results showed that majority of the respondents disagreed with this notion. This implies that the respondents had no confidence in the regulation systems that were meant to streamline the construction of the storey buildings. The study investigated if policy makers often waited until something undesirable happened before implementing controls and policy to resolve the issue and the results indicated that almost all of the respondents agreed. This serves to uphold the work of Hall (2010) that analyzed statistics from fires reported to U.S. municipal fire departments and found that fire sprinklers save lives and are effective and reliable.

Most of the respondents agreed that the high cost discourage construction of safer buildings. The results in reveal that majority of the respondents agree that high costs discourage safe storey building construction. The high costs are likely to have effect on the construction of sustainable buildings. The result was also echoed in the interviews by the owners of the buildings who believe some of the unsafe storey buildings are as a result of high cost of full compliance. This agrees with (Duda 2009) statement that many developers would prefer low cost and lower risk building. Even though costs for green buildings could be reduced by knowledge gained over time from experience there will always be a significant cost in the design and specification due to the nature of the treatment requiring specialist input. The study concluded that there are no license subsidies that could act as incentive for contractors to invest in safe storey buildings. The results show that some of the respondents disagreed to this contention while others

agreed that the financial institution insist on safe storey building prior to financing construction projects. This shows that the banks do not incorporate the issues of safe sustainable storey buildings as part of the requirements before issuance of loans even though they are likely to boost up the efforts towards safe sustainable storey buildings that will enhance occupant's safety.

5.4 Conclusion of the Study

In conclusion, this study contends that safe sustainable storey buildings have social and economic benefits. The study notes that technical personnel in the construction industry need to work together with all stakeholders in the building industry to ensure safe sustainable storey buildings. Scarcity of resources such as energy requires proper saving where possible. Quality building materials are a must in order to avoid disasters. There are no information resources and resource centres from where stakeholder can access crucial information. The study notes that the materials used are usually changed without authorization. This has affected construction of safe sustainable storey building negatively making it hard for the full adoption of sustainable storey building. Another responsibility of local government is to formulate regulations that will strengthen the adherence to adoption of sustainable storey building. Such regulations are not followed and most of them are enacted only after the disastrous events have occurred. This study further observed that minimal incentives to investors in sustainable storey building are offered. This makes the investors reluctant to invest in sustainable storey building.

5.5 Recommendations

The study makes the following recommendations based on the study finding;

1. The study recommends that the technical personnel in the construction industry must work together with all the stakeholders in the building industries in order to ensure safe sustainable storey buildings.
2. The contractors and designers need to be compelled to follow strictly to the required standards of materials for construction of storey buildings.
3. Providing financial incentives to encourage development of sustainable storey buildings by willing investors should be emphasized by the relevant government authorities.
4. Formulation and updating of laws and regulations that provide legal frame work for the development of safe sustainable storey buildings in our municipalities.

5.6 Suggestion for Further Research

This study recommends that further research should be done to establish the effect of forces of demand and supply on the construction of safe sustainable storey buildings in the urban areas. It also recommends research done to obtain alternative cheap but safe construction materials.

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APPENDICES

APPENDIX I: LETTER OF INTRODUCTION

University of Nairobi

P.O Box 30197 00100

NAIROBI

Dear respondent,

RE: COLLECTION OF SURVEY DATA

I am a postgraduate student at the University of Nairobi undertaking a Master of Art Degree in Project Planning and Management. In order to fulfill the degree requirement I am undertaking a research project on factors influencing development of sustainable building in Eldoret Municipality.

You have been selected to form part of this study. This is to kindly request you to assist me collect the data by filling out the accompanying questionnaire. The information/data you provide will be exclusively for academic purposes. I assure you that the information you will give will be treated with strict confidence. At no time will you or your organisation's name appear in my report.

Olbara J Pauline

Student No: L50/78011/2012

APPENDIX II: QUESTIONNAIRE

SECTION A: Demographic Information of Respondents

1. **Respondents' Gender :** Male () Female ()
2. **Age of the respondents:** Below 20 () 20-30 () 31-50 () Above 50 ()
3. **Occupation of the Respondents:** Owners () Supervisors () Contractors () Designers ()
4. **Education Level:** Basic education () Secondary education () College () University ()
5. **Street:**

Street	TICK
Uganda Road	
Elijah Cheruiyot	
Nandi Road	
Moi Street	
Ronald Ngala	
Oloo street	
Kenyatta Street	
Oginga Odinga street	
Others (outside CBD)	

SECTION B: Technical Personnel and the construction of safe sustainable buildings

6. Which of the following safety related factors do you consider satisfactory designed by the architects?
 Room spaces () Ventilation () Lighting ()
7. Which of the following indicator of strength do you approve as strong enough to sustain your buildings structure
 Pillars () Beams ()

8. Which of the following electrical cases occurs less frequently in your buildings?
 Short circuits () Power overload () both occur commonly ()

9. Is communication within the building clear for enhanced business environment
 Yes () No ()

10. Which of the following mechanical cases occurs frequently in your buildings
 Faulty Lifts () Leaking Pipes ()

11. Which of the following civil works cases are a major challenge in your buildings
 Fire Assembly point location () Storm water ()

Section C: Quality of Building Materials and Development of Safe Sustainable Storey Buildings

12. On the following statements indicate the extent to which you agree or disagree on the influence of Quality of Building Materials and Development of Safe Sustainable Storey Buildings.

Statement	Yes	No
Material to be used in construction are inspected prior to construction of storey buildings		
The approved building materials are sometimes changed by the contractors without notification of relevant authorities		
The constructors are always compelled to source the building materials locally.		
The construction industry faces great challenges in high cost of building materials hence cheap less value material opted for.		

Section D: Building Regulations and Construction of Safe Sustainable Storey Buildings

On the following statements indicate the extent to which you agree or disagree on the Building Regulations and Construction of Safe Sustainable Storey Buildings

Statement	Yes	No
Building codes are usually followed to the latter in construction		
All occupants in the offices in the building are safer due to the regulations		
All EIA activities are conducted prior to commencement of a construction project		
The inspectors conduct audits to check on the suitability of the proposed building works		
Continuous monitoring and evaluation is conducted by local authorities to ensure that buildings are constructed as per the standards established		
Policy makers often wait until something undesirable happens before e implementing controls and policy to resolve the issue		
There are presence of fire protection equipment in most buildings		

Section E: Construction Cost and Development of Safe Sustainable Storey Buildings

On the following statements indicate the extent to which you agree or disagree on the Construction Cost and Development of Safe Sustainable Storey Buildings

13. .

Statement	Yes	No
The municipality has instituted licence cost incentives for safer building		
Buildings are rated on the environmental soundness of their homes or facilities thereby providing a quick return on the investment through marketing edge		
The financial institutions insist on safe buildings hence compelling the constructors to ignore the emphasis on the costs		
The high costs of construction discourage development of safe storey buildings		
Investors have become less cost conscious at the expense of safety after understanding that sustainable storey buildings pay in the long run as opposed to the short term		
The installation of safety appliances (fire extinguishers) and provisions (emergency exits) is a very costly activity		

APPENDIX III: INTERVIEW SCHEDULE

1. Gender:.....
2. Age of the respondents:
3. Occupation.....
4. How do you rate the technical personnel within Eldoret?
.....
5. What challenges do you think the technical personnel face?
.....
6. Are the material to be used in construction inspected prior to use in construction
of storey buildings?
7. Do the approved building materials sometimes get changed by the contractors
without notification of relevant authorities?.....
8. Are building codes usually followed to the letter in construction?
.....
9. Are all EIA activities conducted prior to commencement of a construction
project? Yes[] No[]
10. Have investors have become less cost conscious at the expense of safety after
understanding that sustainable storey buildings pay in the long run as opposed to
the short term?.....