FACTORS INFLUENCING AVIATION SAFETY: THE CASE OF KENYA CIVIL AVIATION AUTHORITY

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BY
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A Research Project Report Submitted in Partial Fulfilment of the Requirements for the Award of the Degree of Master of Arts in Project Planning and Management of the University of Nairobi

2015
DECLARATION

This research project is my original work, to the best of my knowledge and it has not been presented for the award of a degree in any other University.

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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 children, Michael and Zawadi, you give me a reason to go on.
ACKNOWLEDGEMENT

I wish to acknowledge my supervisor Dr. Ndunge D. Kyalo and the members of the project defense panel for their input, support and guidance during this period. To the staff and lecturers of the Department of Extra Mural Studies, University of Nairobi, thank you for your support. My colleagues at the International Civil Aviation Organization for providing relevant study background with special mention of Mr. Seboseso Machobane, for taking time to review and critique my work. The Kenya Civil Aviation Authority staff for their insights regarding aviation safety in Kenya and Mr. Eliud Mureithi for his encouragement to keep to my project timelines. I also wish to acknowledge my house assistant, Miss Lilian Atieno for her commitment and sacrifice in looking after my daughter as I pursued my studies. Lastly I owe my gratitude to the different authors and academicians of whose reference materials and books have greatly assisted me to build the literature review for this study.
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<td>Airports Council International</td>
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<td>AD/B</td>
<td>African Development Bank</td>
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<tr>
<td>AFCAC</td>
<td>African Civil Aviation Commission</td>
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<td>AFI Plan</td>
<td>Comprehensive Regional Implementation Plan for Aviation Safety in Africa</td>
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<td>AFI Region</td>
<td>Africa-Indian Ocean Region</td>
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<td>EI</td>
<td>Effective Implementation</td>
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<td>Global Aviation Safety Plan</td>
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<td>SHELL</td>
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ABSTRACT

The study set out to investigate the factors influencing aviation safety; the case of Kenya Civil Aviation Authority which is Kenya’s aviation regulatory body. The research objectives were to establish the extent to which personnel professional qualifications, financial resources, aviation infrastructure and technical guidance material influences aviation safety in Kenya. The target population of the study was employees of the Kenya Civil Aviation Authority (KCAA) and more specifically safety oversight inspectors numbering fifty six (56) and all based at the KCAA headquarters in Nairobi, Kenya. A census approach was used as the researcher was interested in collecting data from every member of the target population. Data was collected using a questionnaire focusing on the research objectives, and collected after a week from the target population. The questionnaire was constructed using structured and unstructured questions. Both descriptive and inferential statistics were used as tools of evaluation in the data analysis. The findings were analyzed by mean scores, standard deviation, correlation co-efficiency and linear regression analysis using SPSS Ver. 20. The findings were presented using Tables. The study established that personnel professional qualifications have a major effect on aviation safety as the KCAA had inadequate qualified safety oversight inspectors and technical safety staff. The study also revealed that the percentage of training execution in the organization was low as the organization appeared inadequately committed towards staff development. The recruitment and retention policies were found to be inadequate which in turn affected the safety oversight officers’ morale and subsequently compromising the overall safety of the industry. Further findings indicated that the organization had put mechanisms in place to ensure financial sustainability which is commendable. From the correlation analysis it was noted that safety technical guidance material had the highest predictor value with a correlation value of 0.590, followed by financial resources having a positive correlation value of 0.410 while aviation infrastructure had a correlation value of 0.303. The smallest predictor of aviation safety was personnel professional qualifications with a correlation value of 0.257. The study concludes that mechanisms in place to ensure financial sustainability have a positive effect on aviation safety as the organization has financial reserves that can be used in the event of a crisis. The study concludes as well that personnel professional qualifications are a major contributor of aviation safety due to the fact that the aviation industry is technical based with rapidly changing technologies, applications and emerging issues. Recruitment and retention policies need to be prioritized in order to attract the appropriate personnel based on the organizational needs. It is recommended that approved revisions to Technical Guidance Material be implemented within the shortest period possible to ensure efficiency. The KCAA should also initiate a motivation and retention programme in order to curb the migration of personnel to other States and industries. The study further recommends that KCAA should carry out a needs assessment analysis of its technical and safety oversight personnel in order to come up with strategies to bridge the human resource gap. It also recommends that the airport safety zones should be clearly demarcated and communicated to the national and county governments through the Ministry of Lands as well as the Ministry of Transport and Infrastructure in order to stop further developments and clear illegal developments along the airports as they compromise civil aviation safety.
CHAPTER ONE
INTRODUCTION

1.1 Background to the Study
While the World War II was still underway, 54 States met in the United States of America on 7 December 1944, formulated and signed the Convention on International Civil Aviation better known as the Chicago Convention. The Convention has since enabled the global civil aviation system to develop safely and systematically by setting global civil aviation regulatory policies and guidelines. It also led to the birth of the International Civil Aviation Organization (ICAO), a United Nations specialized agency which now boasts 191 Contracting States (ICAO Doc 7300).

ICAO is recognized as the organization responsible for facilitating collaboration in the development of international civil aviation Standards and Recommended Practices (SARPs) and ensuring harmonized application of the SARPs to facilitate the continued growth of aviation. Safety is essential for the existence of civil aviation, which is one of the key enablers of the rapidly developing global economy. Recognizing the critical importance of this mandate, the 35th Session of the ICAO Assembly (2004) resolved that ICAO should lead a Unified Strategy to resolve safety-related deficiencies that threaten the viability of civil aviation and the economies that depend on its safety and regularity.

Despite this mandate, ICAO and Contracting States have struggled to address the challenges experienced in the development of civil aviation in the Africa-Indian Ocean region (AFI Region). Stolzer et al (2008) states that although aviation is among the safest mode of transportation in the world today, accidents still happen and in order to further reduce accidents and improve safety, proactive approaches must be adopted by the aviation community. According to a report by the African Development Bank (ADfB, 2012) the performance of the African aviation industry is still lagging behind those of the rest of the world. Nonetheless, demand for air transport has increased steadily over the past years with passenger numbers and freight traffic growing by 45% and 80%, respectively.
Air transport plays a major role in driving sustainable economic and social development worldwide. According to the Global Aviation Safety Plan (GASP 2014-2016) air transport directly and indirectly supports the employment of 56.6 million, over 2.5 billion passengers and $5.3 trillion worth of cargo annually. A case in point for aviation was made in 2010 when Iceland’s volcanic ash led to the closure of 300 European airports for 5 days, over 100,000 cancelled flights, more than 10 million stranded passengers and $5 billion in lost GDP worldwide.

The Yamoussoukro Declaration concerning the liberalization of access to air transport markets in Africa (YD 1998), which was later endorsed by the Assembly of Heads of African States held in Lomé, Togo, in July 2000, created the fundamental basis of Africa’s strategy for the sustainability of air transport, through a harmonized air transport liberalization framework. Taking into consideration the principal features of air transportation, African States confirmed the goal to liberalize access to the air transport market in Africa in its entirety.

Although air transport is among the safest means of transport, risk is a constant reality as is true of any human activity and aviation operations are prone to accidents. The global nature of the aviation industry, the complex and dynamic aviation environment requires that aviation regulators, air operators, and service providers cooperate to maintain a safe air transport system (Dannatt, 2006). According to the GSIE rating contained in the ICAO Safety Report (2014), runway safety related events which include abnormal runway contact, bird strike, ground collision, ground handling, runway excursion, runway incursion, loss of control on ground, collision with obstacle(s), undershoot/overshoot and aerodrome represented 68% of the total number of accidents, 78% of fatal accidents and 80% of all fatalities in 2013. The report further states that, while Africa accounted for the lowest percentage of global traffic volume at only 2%, it had the highest regional accident rate at 10% of the global share.

Cognizant of the major challenges that Africa faces related to aviation safety, several programs have been developed and implemented by various aviation stakeholders. One of the
notable programs developed by ICAO is the Comprehensive Regional Implementation Plan for Aviation Safety in Africa (AFI Plan) established in January 2008 with the aim to support African States in addressing aviation safety deficiencies.

Closer home, the East African Community Civil Aviation Safety and Security Oversight Agency (CASSOA) was established with the support of the AFI Plan and commenced operations on 1st June 2007, as an autonomous self-accounting body of the East African Community following the signing of the Protocol for the Establishment of CASSOA by the three founder Partner States, Kenya, Tanzania and Uganda, on 18th April 2007 during the 5th Extraordinary Summit of EAC Heads of State held in Kampala, Uganda. Despite all these initiatives however, aviation safety within African States remains elusive or negligible.

1.1.1 Kenya Civil Aviation Authority (KCAA)
Kenya is a signatory to the Chicago Convention on International Civil Aviation Organization, and in accordance to Article 37 of the Convention she is obligated to comply with the ICAO SARPs. The Kenya Civil Aviation (Amendment) Act was enacted on 24th October 2002 and became effective on the same day. The Act amended the Civil Aviation Act Cap.394 of the laws of Kenya and established the Kenya Civil Aviation Authority (KCAA) as an autonomous corporate body that took over the functions of the Directorate of Civil Aviation (DCA) and the licensing of air services previously under Civil Aviation Board (CAB). It performs two broad key functions; to provide air navigation services in Kenya's Flight Information Region (FIR) and to regulate the aviation industry in Kenya.

Primary functions of KCAA are regulation and oversight of aviation safety and security, economic regulation of Air Services and development of civil aviation, provision of Air Navigation Services (ANS), and training of aviation personnel.
The KCAA’s overall strategy as reflected in its strategic plan for period 2010-2015 is based on its commitment to provide a safe and efficient civil aviation environment that contributes to the achievement of Kenya’s developmental objectives, as articulated in the Vision 2030. Since its establishment in 2002 KCAA has continued to implement its mandate despite facing various challenges mainly related to funding and level of autonomy. KCAA is undertaking various projects with the aim of delivering its part in Kenya’s Vision 2030 which aims to make Kenya a middle income country by the year 2030. Some of the projects entail a restructuring project comprising aligning organizational structure to its strategy, recruitment, training and retention of competent staff, rightsizing and resourcing the organization appropriately, achieving international safety and security compliance, re-organization of the airspace and modernization of air traffic management systems.

A study carried out by the George Washington University Consortium (2004) indicates that many civil aviation regulatory authorities mandated by national governments to ensure safety and security of air transport operations are not able to sustain effective regulatory activities to match the pace of traffic growth. The ICAO Universal Safety Oversight Audit Programme (USOAP) follow up audit of Kenya conducted in 2013 revealed that the implementation of the Critical Elements (CE) pertaining to establishment of a regulatory system had improved significantly since the comprehensive audit of Kenya in 2008. However, the effective implementation of CEs relating to safety surveillance actions and resolution of safety concerns remained low, 61% and 51% respectively. Amongst others, Kenya had not established a mechanism to ensure the availability of sufficient aviation safety oversight personnel, and the Safety Management System of the aerodrome operator was not fully implemented. In addition, the CE relating to the establishment and effective function of incident and accident investigation remained at 42% low.

Inadequacy of aviation guidance material and oversight capability has the potential to permit unsafe acts and conditions that could hinder identification and resolution of system weaknesses and the attainment of enhanced safety, efficiency and continuity of aviation operations.
According to the Kenya Transport Sector Support Project (P124109), the aviation industry in Kenya has recorded major growth over the last 5 years. For instance, in 2004, about 5.5 million passengers were handled at Kenyan airports. This figure rose to 6.9 million in 2009 and to 8.6 million in 2012. In order to keep pace with this growth and increasing importance of the aviation sector in the development of Kenya, KCAA oversight and regulatory functions require strengthening.

1.2 Statement of the Problem
Since its establishment in 2002 KCAA has carried out its mandate with varying levels of success. Challenges faced by the organization have also been identified in various forums/writings as highlighted by Muthee (2011) and most specifically by the ICAO USOAP audit of 2013. The audit and its follow up identified persisting shortcomings in implementing of safety oversight Critical Elements (CE) key among them Kenya had not established a mechanism to ensure the availability of sufficient aviation safety oversight personnel and up to date technical guidance material for use by the safety oversight personnel and air operators especially in the aerodromes and ground aids domain. Inadequacy of safety oversight personnel and technical guidance material if unchecked has the potential to create unsafe acts that could hinder identification and resolution of safety deficiencies and the attainment of enhanced safety, efficiency and continuity of aviation operations. In spite of these weaknesses, which impact negatively on the attainment of strategic goals and aviation safety no study had been carried out to the researcher’s knowledge, to evaluate the influence of personnel qualifications, technical guidance material, aviation infrastructure and financial sustainability strategies which are the cornerstone of any aviation safety system. It is against this background that this study sought to assess the factors influencing aviation safety in Kenya. The study sought to highlight pertinent issues influencing aviation safety in Kenya.

1.3 Purpose of the Study
The purpose of the study was to establish factors influencing aviation safety in Kenya, the case of Kenya Civil Aviation Authority.
1.4 Objective of the Study

The objectives of the study were:

1) To establish the extent to which personnel professional qualifications influence aviation safety in Kenya.
2) To assess how financial resources influence aviation safety in Kenya.
3) To examine how infrastructure influence aviation safety in Kenya.
4) To determine how technical guidance material influence aviation safety in Kenya.

1.5 Research Questions

The study sought to find answers to the following questions:

1) To what extent does personnel professional qualifications influence aviation safety in Kenya?
2) To what extent do financial resources influence aviation safety in Kenya?
3) To what extent does infrastructure influence aviation safety in Kenya?
4) To what extent do Technical Guidance Material influence aviation safety in Kenya?

1.6 Significance of the Study

The study findings could provide important information that can be integrated by aviation stakeholders to improve Kenya’s aviation safety record. The Ministry of Transport and Infrastructure may use the findings to review aviation regulations and policies with a view to inculcating an aviation safety culture.

Donors and international aviation bodies may use the outcomes of the study to identify and establish programmes that are tailored towards specific challenges facing aviation safety in Kenya. Researchers, academicians and aviation stakeholders could use the findings and recommendations of this study as a reference.

1.7 Limitations of the Study

Some respondents might have had reservations regarding the confidentiality of the feedback that they provide. Some of the safety oversight officers may have had a busy working
schedule which might have been a challenge to get them to respond in a timely manner. In order to overcome this challenge, the confidentiality of the questionnaires was guaranteed by anonymity when filling the questionnaire. This was meant to encourage them to respond freely and honestly. With regard to tight schedules of the respondents, the researcher ensured that the questions were clear and simple to give the respondent the shortest time possible to respond to the questions.

1.8 Delimitations of the Study
The study was bound to the Kenya Civil Aviation Authority, Nairobi. This is because the KCAA is Kenya’s aviation regulatory body and thus an appropriate representative sample of the aviation industry in Kenya.

1.9 Basic Assumption of the Study
The study assumed that;
The study respondents were conversant with the factors influencing aviation safety in Kenya. The respondents were cooperative and honest in giving the required information. The respondents were free of fear or intimidation when giving feedback.

1.10 Definition of significant terms
**Aviation Infrastructure:** This refers to the basic facilities, services and installations for the efficient and effective functioning of the aviation industry. Infrastructure consists of the hard and visible components such as airports, control towers, communication supported by its soft components such as policies and regulations.

**Financial Resources:** Funds that are available to enable an organization meet its mandate.

**Professional Qualifications:** Knowledge, skills and attitudes required to perform a task to a prescribed standard under a certain condition.
Technical Guidance Material: This is a set of written and detailed instructions that document a routine or repetitive activity followed by an organization to achieve uniformity of the performance of a specific function.

Aviation Safety: Aviation safety is a term encompassing the theory, investigation, and categorization of flight failures, and the prevention of such failures through regulation, education, and training. It can also be applied in the context of campaigns that inform the public as to the safety of air travel.

1.11 Organization of the Study
Chapter one entails the background of the study, statement of the problem, purpose of the study, research objectives, research questions, justification and significance of the study, basic assumptions, limitations, delimitation and definition of significant terms used in the study. Chapter two focuses on the introduction of literature review, related empirical literature on factors influencing aviation safety as well as the conceptual framework while chapter three contains the research methodology comprising research design, target population, sampling procedure, research instruments, validity and reliability of the instruments, data collection procedure and data analysis.

In Chapter four the analysed data is presented, interpreted and discussed based on each research objective. Chapter five provides the summary of the findings in chapter four, conclusions and recommendations of the study based on the objectives of the study. Suggestions for further research have been put forth in this chapter as well.
CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction
This chapter discusses the relevant literature that has been reviewed in the area of aviation safety. The study discussed the theoretical review on aviation safety process and the empirical study on the factors influencing aviation safety in Kenya. The chapter also presents the conceptual framework that will be adapted in conducting the study as well as the knowledge gap that exists.

2.2 Aviation Safety
For many years aviation safety was improved only by a reactive “fly-crash-fix-fly” approach. This scenario has so far changed and the approach now is an intensive accident investigation followed by improving technology, operational procedures and advance training (Stolzer et al 2008). The objective of the new approach is to avoid human injury, loss of life, and damage to the environment by using proactive Safety Management Systems (SMS) in the aviation industry. In addition to technical improvements the new focus is to contain and mitigate human error and organizational factors through regulation and training and making improvement on lessons learned from accident and incident investigations.

ICAO mandated that its 191 member States develop and implement Safety Management Systems (SMS). The purpose of the Safety Management Manual (SMM: ICAO DOC 9859) is to support member States in fulfilling the requirements of the ICAO Annexes 6 (Operations), 11 (Air Traffic Services) and 14 (Aerodromes) to the Chicago Convention, with respect to the implementation of SMS by operators and service providers. In response to ICAO, the United States of America Federal Aviation Administration (FAA) introduced the advisory circular Introduction to Safety Management Systems for Air Operators (AC120-92) and the European Aviation Safety Agency (EASA) provided the Notice of Proposed Amendment (NPA 22-2008) as legal basis. These are among the key provisions by States and organizations that play major roles in global civil aviation, highlighting commitment by all stakeholders in the Air Transport System (ATS) to implement SMS.
According to ICAO DOC 9859 safety management in the aerospace industry is a combination of the two perspectives; traditional and modern. The reactive (traditional) safety management approach which responds to events that already happened (incidents and accidents) is useful when dealing only with technical errors or unusual events. The modern or evolving approach to safety management is following a proactive risk management strategy, identifying hazards before they appear in incidents or accidents and taking action to reduce the risks. An additional method for higher safety management level is the predictive method which captures the system performance during operations to identify potential future problems with methods like data mining or modelling. As adapted from AC 120-92, SMS is structured upon four basic components of safety management: policy, safety risk management, safety assurance and safety promotion. These four structural elements were titled by the US Federal Aviation Administration (USFAA) as the four pillars of an effective SMS (Stolzer 2008).

2.3 Personnel Professional Qualifications and Aviation Safety

ICAO has defined competency as “the combination of knowledge, skills and attitudes (KSAs) required performing a task to a prescribed standard under a certain condition”. Competency-based training is not new to military air forces, but for much of the airline industry the application of a competency-based approach has been a most significant challenge for organizations planning MPL training. Most ATOs have never engaged in the development of a competency-based course before. ICAO estimates that the number of commercially operated aircraft will have increased from 61,833 in 2010 to 151,565 in 2030, and the number of departures from around 26 million to almost 52 million. Its projection on human resource requirement up to 2030 shows that more than 2 million jobs will be created for pilots, maintenance personnel and air traffic controllers as a result of retirement of professional staff and the anticipated growth of the industry. The industry growth is expected to more than double the requirements for pilots, maintenance personnel and air traffic controllers during the period. A comparison by the ICAO study of the number of personnel who will require to be trained annually with the capacity of the existing training institutions shows that there is a shortfall of training capacity equivalent to 160,000 pilots, 360,000 maintenance personnel and 40,000 air traffic controllers. The global demand for aviation
personnel is therefore expanding faster than the supply and this has adverse implications on global aviation safety if no action is taken to address the shortage on time.

During the Association of African Aviation Training Organizations (AATO) Consultative Assembly held in Niger in 2013, it was agreed that harmonization of aviation training among African States will offer an opportunity not only to increase the availability of affordable and quality training throughout the continent, but also promotes compatibility among operators and safety oversight organizations, improve efficiency and effectiveness and reduce the economic burden on States and aviation services providers who have to comply with different requirements for the training of their personnel.

A survey carried out by the Association of African Aviation Training Organizations (AATO) in 2012 noted that Africa loses aviation professionals and highly skilled employees trained on meagre resources of civil aviation authorities, air navigation service providers, airports and airlines to other regions outside the continent where more competitive terms of service are offered. The rate of employees leaving is damaging and is increasingly reaching unmanageable levels. This will affect the ability of Africa to deliver quality and safe services if measures are not urgently taken to arrest the situation. The situation is worsened by the rapidly expanding air transport business in Africa that requires more aviation personnel.

According to a report by the Training Expert Working Group (TEWG) (2011) in order to meet the demand for aviation training in Africa, there is a need to invest in the modernization and expansion of the existing training organizations, and/or develop new ones. Investment is required to modernize existing and develop new training facilities including classrooms, training aids such as simulators and learning laboratories, and information technology to be at par with international training standards. Additional operational expenditures will also be required for the training organizations to be able to increase the number of qualified instructors and maintain their qualifications in line with the applicable international requirements. However, in order to attract the funds needed for such investment and sustain the operational expenditures, the training organizations need to improve on their ability to generate adequate funds through their training activities.
During the 19th Airports Council International Africa Regional Conference held in 2011 in Nigeria, the audience was apprised that the ability of the aviation industry in Africa to attract and retain a sufficient number of qualified personnel is challenged by today’s context characterized by ageing personnel complex operational requirements, stiff competition, globalization, lack of planning of aviation human resources requirements at the national and regional level. A report published by African Aerospace Consultants (2015), states that there is need to move from reactive to strategic proactive planning by adopting strategic human resource and by making sure we know what it means to get the right people in the right roles. According to Cable and Parsons (2001), employee retention refers to the techniques employed by the management to help the employees stay with the organization for a longer period of time. Employee retention strategies go a long way in motivating the employees so that they stick to the organization for the maximum time and contribute effectively. Sincere efforts must be taken to ensure growth and learning for the employees in their current assignments and for them to enjoy their work.

Borman and Motwidlo (1993) indicate that the continuing prosperity of an organization is likely to be enhanced by employees who hold attitudes, value and expectations that are closely aligned with the corporate vision. Cable and Parsons (2001) further postulates that, hiring capable people is just a starting point, but building and sustaining a committed workforce is more likely to be facilitated by the employment of sophisticated human resource management infrastructures. Arguably according to Schuler and Jackson (1987) human resource management policies and practices can be strategically designed and installed to promote desirable employee outcomes, which include the enhancement of their role and behaviour. Yet, despite such acknowledgements, organizations and management often time lack the commitment to improve and cement the linkage between employees and their organizations.

2.4 Financial Resources and Aviation Safety
Financial resource allocation and priority setting are challenging issues faced by aviation safety decision makers requiring careful consideration of many factors, including objective such as reason, and subjective like empathy elements (Browman, 2009). Criteria used to
evaluate aviation safety interventions and allocations of resources are likely to have profound implications, especially regarding ethical aspects. Ethical principles of resource allocation set forth include efficiency, fairness and utility (Ghaffar, 2007).

Consideration of these often conflicting principles requires pragmatic frameworks and the engagement of a broad range of stakeholders to provide Accountability for Reasonableness (A4R). Limited resources in aviation safety in both wealthy and developing countries underline the need to allocate optimally (Oncol, 2008). As argued by various authors, choices may not be based on rational and transparent processes highlighting the need for processes that take this into account. Indeed, if the mechanism employed to guide the distribution of financial resources is inequitable, the outcome is also likely to be. Thus, how resources are allocated for aviation safety around the world remains a challenging issue. Priority-setting is defined as the process by which financial resources are allocated among competing programs or people. In the context of increasing aviation safety costs in many countries around the world, effective approaches to explicit appraisal and priority setting are becoming critical to allocate resources to aviation accident interventions that provide the most benefit to the systems’ sustainability, equity and efficiency (Bowen, 2008).

2.5 Infrastructure and Aviation Safety

According to Ali and Pernia (2003) infrastructure consists of hard and soft components. The hard and visible infrastructure, such as roads, railways, electricity, and telecommunications, must be accompanied and supported by its soft component, such as policies and regulations, to enable the system to perform well and generate impacts. The right mix and synergy of the two is important to ensure that the infrastructure system supports inclusive growth and poverty reduction. Well-functioning and efficient infrastructure promotes inclusiveness by expanding access to vital services and improving economic opportunities for all. In a report by Ncube (African Development Bank 2012), he reiterates that the air transport industry faces various challenges including poor airport infrastructures, lack of physical and human resources, limited connectivity, and lack of transit facilities. Although substantial progress has been made during the past decade, Africa still lags behind other regions in terms of “soft”
and “hard” infrastructure. It is therefore critical that African countries invest in the soft as well as hard infrastructure to support the industry.

Vision 2030 is Kenya’s national blueprint which is envisaged to create a prosperous country and good life by 2030. In this vision, infrastructure falls under the economic pillar which include amongst others; accelerating on-going infrastructure development by focusing on quality and functionality; building infrastructure in support of identified flagship projects which contribute to social equity and economic goals; improving efficiency and effectiveness of infrastructure at all levels of planning, contracting and constructing. The Government has put more emphasis on infrastructure development; a number of strategies were employed to improve the available infrastructure facilities to maximize economic and social goals (GoK, 2007).

The vision proposes a number of strategies to be pursued including strengthening the existing framework and accelerating the speed of implementation. Others will include raising efficiency and quality of infrastructure, enhancing local content of identified projects, support identified flagship projects, benchmarking infrastructure facilities with globally accepted standards and targeting projects in neglected areas to increase connectivity and stimulate economic activities. In addition the vision hopes to enhance Private Sector participation in provision of infrastructure facilities and services strategically complimented by Public Sector Interventions; Infrastructure Financing through Capital Markets. The government has expressed its intention to increase private sector participation in the provision of infrastructure services to rehabilitate the national infrastructure. It wishes to do so in order to lower the costs of doing business in Kenya, provide affordable and efficient modes of transport for Kenya and increase overall living standards.

In 2011 the Kenya Airports Authority launched a five year strategic plan that has become the blueprint for the development of all the Kenyan airports. Consequently Jomo Kenyatta International Airport (JKIA) has seen unprecedented growth as a result of the implementation of five key areas that are entrenched in the strategic plan which were, Revenue Enhancement and Business Growth, Product and Service Improvement, Infrastructural development,
Business Process Automation and the positioning of JKIA as the Premier Hub of Africa. Despite all these initiatives, the increased air traffic flow, rapid technological change and lack of sustainable strategies could still be a hindrance in maintaining the current infrastructure.

2.6 Technical Guidance Material and Aviation Safety

According to ICAO Doc. 9734 Part A (2006) technical guidance material, tools and the provision of safety-critical information falls under the Universal Safety Oversight Audit Programme Critical Element 5. According to a report by the U.S Environmental Protection Agency (2012) every organization should have a set of written and detailed instructions that document a routine or repetitive activity followed by an organization to achieve uniformity of the performance of a specific function. It further describes guidance material asset of steps that a person or group of people must perform to complete a job by eliminating variation and creating uniformity. Technical Guidance Material (TGM) specifies in writing what should be done, how, when, where and by whom.

ICAO further emphasizes that the provision of TGM includes processes and procedures, tools and safety-critical information which should be made available to technical personnel to enable them to perform their safety oversight functions in accordance with established requirements and in a standardized manner. This includes the provision of technical guidance by the oversight authority to the aviation industry on the implementation of applicable regulations and instructions. The effectiveness of a safety oversight system and the implementation of national and international Standards need to be supported by guidance material which will provide the technical experts with guidance on how to accomplish their specific functions. ICAO has developed and published technical guidance to assist States in implementing Annex provisions.

The 11th meeting of the Air Transport Regulation Panel (ATRP/11) held in Montreal, Canada on June 2012, noted that while ICAO guidance and policies remained relevant, there was a lack of awareness to some extent and implementation by States. To improve the situation, the Secretariat stressed the need for more effective tools and means to promote
ICAO policy guidance, including working with States, the industry and other relevant organizations to improve implementation of ICAO’s policy guidance. One suggested means was to encourage States to incorporate ICAO principles, policies and guidance, in national legislation, policies and regulations. Encourage States to develop and publish their own technical guidance material to assist their technical experts in implementing national regulations, procedures and practices. Such material should include information on how to process an application for a licence, rating, certificate or approval; evaluate claims made on an application form; and evaluate experience. The State’s technical guidance should also include guidance on the implementation of applicable regulations, instructions and directives.

ICAO further emphasizes that in order to foster safety in the aviation operational environment, the supply and speedy dissemination of safety-critical information, such as a Notice to Airmen (NOTAM) and airworthiness directives, are essential. The importance of the regular amendment and updating of publications such as aeronautical maps and other aviation-related publications should not be discarded in respect of its role in ensuring a safe operating environment. Therefore, TGMs act as a blueprint for States to implement ICAO SARPs and Annexes.

2.7 Theoretical Framework of Aviation Safety

This section presents relevant theories that were reviewed during this study. The safety models include the SHELL Model of human factors, Swiss Cheese Model and the Domino Effect Model.

2.7.1 The SHELL Model of human factors in Aviation Safety

The SHELL Model is defined as “the relationship of human factors and the aviation environment” (Reinhart, 1996). This concept originated from the ‘SHEL Model’ by Edwards in 1972, whereby the name was derived from the initials of its components (Software, Hardware, Environment, and Live-ware). In 1975, Hawkins developed the concept into the ‘SHELL Model’ with an introduction of another Live-ware into the original concept, ‘SHEL Model’ (Hawkins, 1987). The most different point between Edwards’s SHEL Model (1972) and Hawkins’s SHELL Model (1975) is that Hawkins urged for the necessity of another
‘Live-ware’ (the person) and illustrated the interactions between the central Live-ware and each of other four systems (Hawkins, 1987).

It was generally noted that most of the air accidents are related to human errors, while the mechanical failures in aircraft maintenance today has enormously been on the decrease with a number of new high technological equipment inventions (Hawkins, 1987). Furthermore, in the perception of human factors, every individual, either who takes part in the operation or the supporting part of aviation, has individual capabilities and limitations. Thus, many countries in the world strive to secure the safety by training based on the interactions of each of SHELL components (Hawkins, 1987).

The main elements in the model can be identified as hardware which entails various equipment, tools, aircraft, workspace, buildings and other physical resources without human elements in aviation; the software comprises all non-physical resources such as organizational policies, rules, procedures, manuals and placards. The next element is the environment which entails not only the factors which influence where people are working such as climate, temperature, vibration and noise, but also socio-political and economic factors. The live-ware includes factors like teamwork, communication, leadership and norms. The central live-ware can be defined as human elements such as knowledge, attitudes, cultures and stress. This live-ware is regarded as the core of the SHELL Model and other components match with the live-ware as the central figure (Hawkins, 1987).

2.7.2 Swiss Cheese Model on Aviation Safety

According to Wiegmann & Shappell (2003) industry-wide acceptance of the concept of the organizational accident was made possible by a simple, yet graphically powerful model developed by Professor James Reason, which provided a means for understanding how aviation operates successfully or drifts into failure. According to the Swiss cheese model also known as the Reason model, accidents require the coming together of a number of enabling factors, each one necessary, but in itself not sufficient to breach system defences. Professor Reason argues that, complex systems such as aviation are extremely well-defended by layers of defences in-depth, single-point failures are rarely consequential in the aviation system.
Equipment failures or operational errors are never the cause of breaches in safety defenses, but rather the triggers. Breaches in safety defenses are a delayed consequence of decisions made at the highest levels of the system, which remain dormant until their effects or damaging potential are activated by specific sets of operational circumstances. Under such specific circumstances, human failures or active failures at the operational level act as triggers of latent conditions conducive to facilitating a breach of the system's inherent safety defenses. In the concept advanced by the Reason model, all accidents include a combination of both active and latent conditions.

The Swiss cheese model of accident causation likens human system defences to a series of slices of randomly-holed Swiss cheese arranged vertically and parallels to each other with gaps in-between each slice. Reason hypothesizes that most accidents can be traced to one or more of four levels of failure: organizational influences, unsafe supervision, preconditions for unsafe acts, and the unsafe acts themselves. In the Swiss cheese model, an organization's defences against failure are modelled as a series of barriers, represented as slices of the cheese. The holes in the cheese slices represent individual weaknesses in individual parts of the system, and are continually varying in size and position in all slices. The system as a whole produces failures when holes in all of the slices momentarily align, permitting a trajectory of accident opportunity so that a hazard passes through holes in all of the defences, leading to an accident.

2.7.3 The Domino Effect Theory on Aviation Safety

The Domino Safety Theory was developed by pioneer industrial safety experts H.W. Heinrich (1931) and Alfred Lateiner to provide a graphic sense of how industrial injuries can occur and how they can be avoided as well. The domino effect theory is also known as the cause-effect theory or causal model. According to the Domino effect theorists, an accident occurs from a sequence of events. It is a chain reaction. In order to grasp the sequence, picture five dominoes in a row, the first domino is background which represents a worker’s lifestyle and personality. The second domino is personal characteristics representing a worker’s attitude, level of knowledge, and physical and mental conditions. The third domino is unsafe acts and unsafe conditions represented by a worker’s behavior and unsafe
job conditions. The fourth domino is the accident represented by an unplanned event caused by an unsafe act or condition. The fifth domino is the injury represented by someone getting hurt.

The Domino theorists contend that for any given incident, not much can be done about a worker’s background and personal characteristics. The domino that must be targeted is unsafe acts and unsafe conditions. When an unsafe act is detected, the worker should be stopped; the situation should be studied; a safer way to perform the task must be found; instruct and train the worker to do it the safer way; check and retrain as necessary; and as a last resort discipline the worker. When an unsafe condition is detected, the condition needs to be removed, guarded, or warned against. Heinrich insists that the responsibility lies first of all with the employer. Heinrich specifies that a truly safety-conscious manager will make sure his foremen and workers do as they are told, and exercise his prerogative and obtain compliance follow through and see the unsafe conditions are eliminated. Heinrich’s remedy for such non-compliance is strict supervision, remedial training, and discipline.

Indeed, there are a number of perspectives on human error, each of which is characterized by a common set of assumptions about the nature and underlying causes of errors. Unfortunately, from the practitioner's point of view, there often appears to be as many human error models and frameworks as there are people interested in the topic (Senders & Moray, 1991). Even worse, most error models and frameworks tend to be theoretical and academic, making them of little benefit to the applied needs of practitioners.

### 2.8 Conceptual Framework
Conceptual frameworks can act like maps that give coherence to empirical inquiry. Because conceptual frameworks are potentially so close to empirical inquiry, they take different forms depending upon the research question or problem, (Heppner and Wampold, 2005).
Figure 1: Conceptual Framework

Figure 1 presents the Conceptual Framework on factors influencing aviation safety in Kenya.

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>Moderating variable</th>
<th>Dependent variable</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Professional Qualifications</strong></td>
<td>• Government policies</td>
<td><strong>Aviation Safety</strong></td>
</tr>
<tr>
<td>• Organization commitment</td>
<td></td>
<td>• Attainment of 60% and above on effective implementation of safety critical elements</td>
</tr>
<tr>
<td>• Conducive working environment</td>
<td></td>
<td>• Timely safety hazard identification</td>
</tr>
<tr>
<td>• Staff Needs Assessment</td>
<td></td>
<td>• Reduced air accidents</td>
</tr>
<tr>
<td>• Staff Training</td>
<td></td>
<td>• Reduced fatalities</td>
</tr>
<tr>
<td>• Motivation Programmes</td>
<td></td>
<td>• Effective Emergency response</td>
</tr>
<tr>
<td><strong>Financial Resources</strong></td>
<td>• Staff attitude</td>
<td><strong>Intervening Variable</strong></td>
</tr>
<tr>
<td>• Sufficient funding for air operations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Financial Sustainability</td>
<td>• Staff Perception</td>
<td></td>
</tr>
<tr>
<td>• Financial Independence</td>
<td>• Organization</td>
<td></td>
</tr>
<tr>
<td>• Appropriate fund allocation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Fraud Management</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Infrastructure</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Conformance to stipulated international standards</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Ability to handle air traffic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Up-to-date technology</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Technical Guidance Material</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Up-to-date guidance material</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Standardized operations</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2.9 Knowledge Gap

A study carried out by Chocho (2008) on Performance of the Aviation Regulatory System in Kenya focused on the influence of aviation safety standards on aviation regulatory performance, effects of aviation security standards, efficiency and continuity of aviation operations and how the civil aviation law affected regulatory performance while Nyaga (2008) undertook a study to investigate the Factors affecting the Successful Implementation of Safety Management Systems (SMS) in the Aviation industry in Kenya. The parameters of the study were the effects of organization’s management commitment on the implementation of safety management systems in aviation industry, organizational culture, and if need for training affect the implementation of safety management systems in Kenya Civil Aviation Authority. Gathai (2012) carried out a study on factors influencing implementation of performance contracting in state corporations in Kenya with special reference to Kenya Civil Aviation Authority. The study sought to establish the effects of employee turnover on implementation of performance contracting at Kenya Civil Aviation Authority, effect of employee sensitization on implementation of performance contracting at Kenya Civil Aviation Authority, Performance measurement on implementation of performance contracting at Kenya Civil Aviation Authority, Organizational commitment on implementation of performance contracting at Kenya Civil Aviation Authority and Organizational culture on implementation of performance contracting at Kenya Civil Aviation Authority. Muthee (2002) conducted a study on Disaster Preparedness and Mitigation at the Jomo Kenyatta Airport which is Kenya’s largest airport focusing on Kenya’s disaster preparedness and mitigation strategies. It’s against this background that the researcher felt that there was need to undertake a study geared towards finding out the factors influencing aviation safety and to focus on the Kenya Civil Aviation Authority which is Kenya’s aviation regulatory body. The study sought to research on four parameters namely: personnel professional qualifications, aviation infrastructure, financial resources and technical guidance material with a view to establishing the influence they had on aviation safety in Kenya.
2.10 Summary of Literature Review

This chapter discussed in details the concept of aviation safety. It highlighted that aviation safety can only be enhanced by proactive measures instead of reactive measures. The aviation system involves a complex interaction between different technical and human centred sub-systems operated by a wide range of different stakeholders (airlines, airports, air navigation service provider and maintenance repair and overhaul etc.). Each organization must manage the hazards that fall under their managerial control, but should also co-operate with other stakeholders to help manage interactions and interfaces. In this complex hierarchy of different systems, a safety outcome in one system could cause hazards in another system. A holistic approach to safety oversight measures is an essential input to safety management decision-making. It is important to ensure that good safety performance is attributable to good performance of the safety system, not simply to lack of incidents. An approach to worldwide safety monitoring and data collection supports the development of safety indicators at national, regional and perhaps at global level. While each safety model has its merits and demerits, there is no one size fits all. Sometimes it is combination of a few elements from each to make a comprehensive whole.

Despite rapid gains in technology, humans are ultimately responsible for ensuring the success and safety of the aviation industry. They must continue to be knowledgeable, flexible, dedicated, and efficient while exercising good judgment. Meanwhile, the industry continues to make major investments in training, equipment, and systems that have long-term implications. Because technology continues to evolve faster than the ability to predict how humans will interact with it, the industry can no longer depend as much on experience and intuition to guide decisions related to human performance. Instead, a sound scientific basis is necessary for assessing human performance implications in design, training, and procedures just as developing a new wing requires sound aerodynamic engineering.

It is indisputable that the ultimate and necessary cause of all technological disasters relates to human actions. As has been argued through the various safety concepts under review, though, the accident without a significant contribution from active failures is a relatively rare event, accidents occur due to varying proportions of predisposing factors and precipitating events, and many require an active trigger to keep the window of accident opportunity open.
CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Introduction
This chapter discusses the research methodology that was used in this study and provided a general framework for this research. The chapter presents details of the research design, target population, sample and sampling procedures, description of research instruments, validity and reliability of instruments, data collection procedures, data analysis techniques and ethical considerations while conducting the study.

3.2 Research Design
Ogula (2005) describes a research design as a plan, structure and strategy of investigation to obtain answers to research questions and control variance. Additionally, a study design is the plan of action the researcher adopts for answering the research questions and acts as a blueprint of the researcher (Kerlinger, 1973). This study adopted a survey research design. This design as defined by Orodho (2003) is a method of collecting information by interviewing or administering a questionnaire to a sample of individuals. The main feature of survey research design is to describe specific characteristics of a large group of persons, objects or institutions, through questionnaires (Kothari 2004). Besides, the design was used because of its descriptive nature in order to assist the researcher in collecting data from members of the sample population for the purpose of estimating the population parameters. Kothari (2004) recommends the use of descriptive research design where the researcher wants to establish certain facts about the problem.

3.3 Target Population
The target population for this research was 56 safety oversight inspectors at the Kenya Civil Aviation Authority (KCAA), from different functional units as shown in Table 3.1.
### Table 3.1 Target Population

<table>
<thead>
<tr>
<th>Department</th>
<th>No. of Employees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerodrome and Ground Aids Inspectors</td>
<td>7</td>
</tr>
<tr>
<td>Meteorology and Aeronautical Inspector</td>
<td>1</td>
</tr>
<tr>
<td>Air Navigation Services and Search and Rescue</td>
<td>2</td>
</tr>
<tr>
<td>Communication Navigation and Surveillance</td>
<td>1</td>
</tr>
<tr>
<td>Flight Operations</td>
<td>13</td>
</tr>
<tr>
<td>Aircraft Airworthiness</td>
<td>18</td>
</tr>
<tr>
<td>Personnel Licensing</td>
<td>6</td>
</tr>
<tr>
<td>Aviation Security and Facilitation</td>
<td>8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>56</strong></td>
</tr>
</tbody>
</table>

### 3.4 Sample Size and Sampling procedure

A census approach was used since the researcher wished to enumerate the whole unit entailing all the safety oversight inspectors in the various departments. The target population was also located in the same geographical location (KCAA Nairobi). According to Kothari (2004) the use of a census survey ensures that all the items are covered and no element of chance is left which ensures a higher rate of accuracy.

A sample is a smaller group or sub-group obtained from the accessible population (Mugenda and Mugenda, 1999). This subgroup is carefully selected so as to be representative of the whole population with the relevant characteristics. Each member or case in the sample is referred to as subject, respondent or interviewee. Sampling is a procedure, process or technique of choosing a sub-group from a population to participate in the study (Ogula, 2005). It is the process of selecting a number of individuals for a study in such a way that the individuals selected represent the large group from which they were selected. The sample frame of the study included all the safety oversight inspectors at the Kenya Civil Aviation Authority (KCAA).
3.5 Research Instruments
This research was based on primary data. Primary data is information that is collected directly from the field specifically for the purpose of a research project with a view to address the problem in question (Salant & Dillman, 1994). This research utilized questionnaire containing structured and unstructured questions to collect data. The questionnaire was administered to the selected sample elements. The questionnaire was divided into five sections. The first section focused on personal and professional aspects of the respondents while the other four sections focused on the four research variables. Annum (2014) states that a questionnaire is a form or document with a set of questions deliberately designed to elicit responses from respondents or research informants for the purpose of collecting data or information. Structured questionnaires are those in which some control or guidance is given for the answer while the unstructured one gives the respondents an opportunity to give a varied response or personal opinion and perception.

3.6 Pilot Study
The questionnaire was pilot tested on 10% of the members outside that sampling frame specifically from the Kenya Airports Authority (KAA) who did not comprise the final sample. These were 5 respondents undertaking safety oversight duties as the sampling frame. The responses obtained from this pilot were used to determine the discrimination, validity and reliability of the questionnaire after which the relevant amendments made to the questionnaire. According to Field (2004) discrimination of a questionnaire means that people with different scores on a questionnaire, should differ in the construct of interest to the study.

The term pilot study is used in two different ways in social science research. It can refer to feasibility studies which are small scale versions, or trial runs, done in preparation for the major study. However, a pilot study can also be the pre-testing or trying out of a particular research instrument. A pilot study might give advance warning about where the main research project could fail, where research protocols may not be followed, or whether proposed methods or instruments are inappropriate or too complicated (Baker, 1994). The
respondents, who participated in the pilot study, were not part of the target population. The data collected during the pilot study was entered into SPSS and a reliability test conducted.

3.7 Validity and Reliability of the Research Instrument

According to Bridget and Lewin (2005), validity is the degree by which the sample of test items represents the content the test is designed to measure. Saunders et al., (2007) indicated that content validity is a measure of the degree to which data collected using a particular instrument represents a specific domain or content of a particular concept as intended. Lacity and Jansen (1994) define validity as making common sense, and being persuasive and seeming right to the reader while Cronbach, (1971), indicated that validity refers to results that have the appearance of truth or reality. Reliability as defined by Field (2004) is basically the ability of the questionnaire to produce the same results under the same conditions. To be reliable, the questionnaire must first be valid.

3.7.1 Validity of the Research Instrument

A pilot study was conducted to refine the research instrument so that results obtained would be a true representation of the actual situation. To establish the validity of the research instrument the researcher sought the opinions of experts in the area of study especially the researcher’s supervisor and lecturers. This facilitated the necessary revision and modification of the research instruments thereby enhancing validity.

3.7.2 Reliability of the Research Instrument

The simplest statistical technique to test for reliability is the split-half method. This method randomly splits the questionnaire items into two groups. A score for each subject is then calculated based on each half of the scale. If a scale is very reliable a respondent’s score will be the same on one half of the scale as the other, and so the two halves should correlate perfectly (Kothari 2004). The correlation between the two halves is the statistic computed in the split half method, large correlations being a sign of reliability. The problem with this method is that there are a number of ways in which a set of data can be split into two and so the results might be a result of the way in which the data has been split.
A solution to this problem was developed by Cronbach and Meele (1955) who suggested that the data should be split into two in every conceivable way and correlation coefficient computed for each split for each split. The average of these values is known as Cronbach’s alpha, which is the most common measure of scale reliability. A value of 0.8 is seen as an acceptable value for Cronbach’s alpha whereas values substantially lower indicate an unreliable scale. To test the reliability of the research instruments, Cronbach alpha test was conducted. According to Brown, (1996) a Cronbach alpha of at least 0.700 implies there is adequate internal consistency reliability of the test instrument. A Cronbach alpha test was conducted to check the reliability of the responses from the pilot test. The pilot test results revealed that the data collection instrument was reliable and valid as a few amendments were made after the pilot test and all the responses recorded a Cronbach alpha result greater than the minimum 0.700 hence the internal consistency of the data collection instrument was adequate.

Table 3.2 Pilot test results

<table>
<thead>
<tr>
<th>Variable</th>
<th>Cronbach (α)</th>
<th>Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional qualifications</td>
<td>0.865</td>
<td>Accepted</td>
</tr>
<tr>
<td>Financial Resources</td>
<td>0.921</td>
<td>Accepted</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>0.765</td>
<td>Accepted</td>
</tr>
<tr>
<td>Technical Guidance Material</td>
<td>0.831</td>
<td>Accepted</td>
</tr>
<tr>
<td>Aviation safety</td>
<td>0.861</td>
<td>Accepted</td>
</tr>
</tbody>
</table>

3.8 Data Collection Procedure

The researcher obtained a research permit from the National Science, Technology and Innovation (NACOSTI), after which the permit was presented to the Nairobi County Commissioner Office, Nairobi Country Education Office and the Director General’s Office at the Kenya Civil Aviation Authority. The questionnaires were then distributed to the respondents by the researcher at their place of work. The questionnaire was divided into five sections. The first section focused on personal and professional aspects of the respondents while the other four sections focused on the four research objectives. Feedback from the
respondents was collected after one week. The responses from the duly filled questionnaires were coded for analysis.

3.9. Data Analysis
According to Shamoo and Resnik (2003) data analysis is the process of systematically applying statistical and/or logical techniques to describe and illustrate, condense and recap, and evaluate data. Data analysis involves goals; relationships; decision making; and ideas, in addition to working with the actual data itself. Simply put, data analysis includes ways of working with data to support the goals and plans of research. An effective data analysis process is functional, useful and adds value to organizational services and individual practices.

The study used SPSS version 20 to facilitate the analysis of data. SPSS was used to undertake calculation on the data. Illustrative data representation devices and tools were adopted to diagrammatically represent and analyze the data. A Pearson’s correlation between the dependent variable and each of the independent variables was also computed for each of the independent variables and the dependent variable to determine the nature of the relationship that existed between the variables and the strength of such a relationship. Data was further analyzed to using standard deviation and linear regression.

3.10. Ethical issues
Greener (2008), states that ethics relate to moral choices affecting decisions and standards and behaviour. Research ethics provides guidelines for the responsible conduct of research. In addition, research ethics educates and monitors research conduct to ensure a high ethical standard. Dworkin (2003) identifies the following ethical issues in relation to research: informed consent, objectivity, practitioner study, plagiarism, privacy and confidentiality as well as safety. The study maintained objectivity in undertaking the study. Any respondents who participated in the study did soon their free will and with the full information of what the research was intended for. There was unlikely to be a case of practitioner study since the researcher is not a member of any of the organizations under study. The study credited past studies used in this study with their authors in order to avoid plagiarism. The privacy and
confidentiality of the respondents was maintained by the study by not disclosing any of the respondents’ identities. Due to the non-experimental nature of the research there were no injuries on the respondents.

The researcher explained to the respondents about the research and that the study was for academic purposes only. It was also made clear that their participation was voluntary and that the respondents were free to decline or withdraw any time during the research period. Respondents were not be coerced into participating in the study. The participants had informed consent to make the choice to participate or not. They were guaranteed that their privacy was protected by strict standard of anonymity.

**Table 3.3 Operational definition of Variables**

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Variables</th>
<th>Indicators</th>
<th>Measurement scale</th>
<th>Tools of Analysis</th>
<th>Specific Tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>To establish the extent to which professional qualifications influence aviation safety in Kenya.</td>
<td><strong>Independent:</strong> Professional qualifications</td>
<td>-Training -Organization Commitment. -Working environment. -Staff Empowerment -Capacity building.</td>
<td>-Interval -Nominal -Nominal</td>
<td>Central Tendency Dispersion, and Causal relationship</td>
<td>Mean, standard deviation, Correlation analysis and linear Regression analysis</td>
</tr>
<tr>
<td></td>
<td><strong>Dependent:</strong> Aviation safety in Kenya.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>To determine how financial resources influences aviation safety in Kenya.</td>
<td><strong>Independent:</strong> Financial resources</td>
<td>-Sufficient funding -Financial sustainability -Financial independence -Appropriate fund allocation -Fraud management</td>
<td>-Interval -Nominal -Nominal -Interval</td>
<td>Central Tendency Dispersion, and Causal relationship</td>
<td>Mean, standard deviation, Correlation analysis and linear Regression analysis</td>
</tr>
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</tr>
<tr>
<td>To find out the influence of aviation infrastructure on safety in Kenya.</td>
<td><strong>Independent:</strong> Aviation Infrastructure</td>
<td>-Conformance to stipulated international standards -Ability to handle air traffic -Up-to-date technology -Sustainability measures -Scheduled routine maintenance</td>
<td>-Interval -Nominal -Nominal</td>
<td>Central Tendency Dispersion, and Causal relationship</td>
<td>Mean, standard deviation, Correlation analysis and linear Regression analysis</td>
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</tr>
<tr>
<td>To establish the influence of technical guidance material on aviation safety in Kenya.</td>
<td><strong>Independent:</strong> Technical Guidance Material</td>
<td>-Up-to-date guidance material -Standardized operations procedures -A blueprint for all aviation stakeholders -Reduced variations</td>
<td>-Interval -Nominal -Nominal</td>
<td>Central Tendency Dispersion, and Causal relationship</td>
<td>Mean, standard deviation, Correlation analysis and linear Regression analysis</td>
</tr>
</tbody>
</table>
CHAPTER FOUR
DATA ANALYSIS, PRESENTATION, INTERPRETATION AND DISCUSSIONS OF THE FINDINGS

4.1 Introduction
This chapter presents the findings of the study, factors influencing aviation safety in Kenya. Analysis was done using statistical package for social sciences (SPSS). A Pearson’s correlation analysis and linear regression analysis of each variable was undertaken in order to bring out the effect of the dependent variable on the independent variables.

4.2 Response Rate
The study targeted 56 respondents in the data collection however, 50 of the 56 questionnaires sent out were answered and returned making a response rate of 89%. This response rate is considered as good and was achieved through the cooperation of the respondents and the diligent efforts made by the researcher to ensure a reliable response.

4.3 Demographic Characteristics of Respondents
In order to obtain the demographic characteristics of the respondents, information as regards to gender, education level and work experience was sought.

Table 4.1: Gender Distribution of Respondents

<table>
<thead>
<tr>
<th>Gender</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>29</td>
<td>58</td>
</tr>
<tr>
<td>Female</td>
<td>21</td>
<td>42</td>
</tr>
<tr>
<td>Total</td>
<td>50</td>
<td>100</td>
</tr>
</tbody>
</table>

From the findings in table 4.3, the majority (58.7%) of the respondents were male while (42%) were female. The findings indicate that the majority of the safety oversight officers
were male in charge of various aviation safety domains and thus a slight imbalance exists between the genders at the KCAA.

Table 4.2: Academic Qualifications of Respondents

<table>
<thead>
<tr>
<th>Academic Qualifications</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced Certificate</td>
<td>15</td>
<td>30</td>
</tr>
<tr>
<td>Diploma</td>
<td>16</td>
<td>32</td>
</tr>
<tr>
<td>Degree</td>
<td>9</td>
<td>18</td>
</tr>
<tr>
<td>Master’s Degree</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>50</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

From the findings in table 4.4 it is shown that 30% of the respondents indicated that they had advanced certificates, 32% had diplomas, and 18% had degrees whereas 20% had master’s degrees. This indicates that the majority of the personnel are holders of diplomas. A lower level of education in some cases might be an impediment on personnel performance as compared to having a more educated workforce.

Table 4.3: Work Experience of Respondents

<table>
<thead>
<tr>
<th>No. Of Years</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than one year</td>
<td>Nil</td>
<td>0</td>
</tr>
<tr>
<td>1-5 years</td>
<td>15</td>
<td>30</td>
</tr>
<tr>
<td>5 years and above</td>
<td>35</td>
<td>70</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100</strong></td>
<td></td>
</tr>
</tbody>
</table>

From the findings in table 4.5 it is shown that 30% of the respondents indicated that they had worked for the KCAA for a period of between 1 to 5 years while 70% had been with the organization for 5 years and above. It was worth noting that none of the respondents had
been with the organization for less than one year. This indicates that most of the safety oversight officers have worked for the organization for 5 years and above. Accumulated years of work experience could have a positive impact on personnel performance because the duties become more familiar and thus easy to undertake.

4.4 The Influence of Personnel Professional Qualifications on Aviation Safety

A five point Likert scale was used by the respondents to indicate the extent to which qualified personnel influence aviation safety in Kenya. The rating scales were: 1 = Poor, 2 = Below Average, 3 = Average, 4 = Above Average and 5 = Excellent. The mean and standard deviations were generated from SPSS and are as illustrated in Table 4.6

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>The number of qualified safety inspectorate staff is adequate in your department.</td>
<td>2.7931</td>
<td>0.75846</td>
</tr>
<tr>
<td>The number of qualified technical safety staff in the safety management system</td>
<td>2.5690</td>
<td>0.94982</td>
</tr>
<tr>
<td>Effectiveness of methods used to determine adequate staff requirements.</td>
<td>3.0966</td>
<td>0.84955</td>
</tr>
<tr>
<td>The organization’s personnel who are deployed to provide flight safety oversight are sufficiently qualified.</td>
<td>3.0846</td>
<td>0.92804</td>
</tr>
<tr>
<td>Training offered is innovative and responsive to the needs of the aviation industry.</td>
<td>3.0690</td>
<td>0.05426</td>
</tr>
<tr>
<td>The percentage of training execution in the organization</td>
<td>2.0846</td>
<td>0.23414</td>
</tr>
<tr>
<td>Your assessment of the organization’s commitment to staff development</td>
<td>3.2000</td>
<td>0.84690</td>
</tr>
<tr>
<td>The working environment is conducive to personnel.</td>
<td>3.9000</td>
<td>0.95953</td>
</tr>
</tbody>
</table>
The extent to which inspectorate staff is empowered to carry out its job including resolution of safety concerns.  

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Mean Score</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Your overall assessment of opportunities for development in your department.</td>
<td>3.3333</td>
<td>0.71116</td>
</tr>
<tr>
<td>The organization plans for new technologies based on emerging trends, identifies and manages threats to aviation operations.</td>
<td>4.2333</td>
<td>0.67891</td>
</tr>
<tr>
<td>Your organization have an effective recruitment and retention policy that include employee benefits</td>
<td>2.2333</td>
<td>0.67891</td>
</tr>
<tr>
<td>Requests for training are effectively addressed by the relevant department in-charge of training</td>
<td>3.1342</td>
<td>0.72793</td>
</tr>
</tbody>
</table>

From the findings, it was evident that the organization has plans for new technologies based on emerging trends, which had the highest mean score of 4.233. The other parameter that had a high mean score was the working environment in which most of the respondents felt that it was conducive as this parameter had a mean score of 3.9. The respondents were also contented with the opportunities for development in their departments as this parameter had a mean score of 3.333.

The organization’s commitment to staff development alongside the empowerment of inspectorate staff to carry out its job including resolution of safety concerns had a threshold acceptable mean score of 3.2 in each case. It was observed that the overall qualifications of the organization’s personnel who were deployed to provide flight safety oversight alongside the innovativeness and responsiveness of the training offered scored average mean scores of 3.06 and 3.08 respectively. The study established that the number of qualified safety inspectorate and qualified technical safety staff in the safety management system were dimmed inadequate as these parameters scored the lowest mean scores of 2.79 and 2.56 in each case.
From the analysis, it can be observed that the KCAA applies a proactive approach to embracing new technology based on emerging trends which scored a high mean score of 4.2. According to ICAO Doc 9859 safety management in the aerospace industry, the reactive (traditional) safety management approach responds to events that already happened (incidents and accidents) whereas the modern or evolving approach to safety management is following a proactive risk management strategy; identifying hazards before they appear in incidents or accidents and taking action to reduce the risks. However, personnel qualifications and training executions need to go hand in hand with new technologies. The parameter used to measure the number of qualified technical safety staff in the safety management system scored low mean scores of 2.5 in a five point scale. This is confirmed by a report published by African Aerospace Consultants (2015), which points out the need to move from reactive to strategic proactive planning by adopting strategic human resource management and making sure there is knowledge on what it means to get the right people in the right roles.

The study further observes that there exist a gap between the supply of well qualified personnel and demand for the same at the KCAA. The respondents were not contented with the training they received as they felt that training offered was not innovative and responsive to the needs of the aviation industry as this parameter scored a low mean of 3.2 and the percentage of training execution in the organization was very low with a mean score of 2.0. This is in line with the sentiments of ICAO which reveal and caution that the global demand for aviation personnel is expanding faster than the supply and this will have adverse implications on global aviation safety if no action is taken to address the shortage on time. Cable and Parsons (2001) further postulates that, hiring capable people is just a starting point, but building and sustaining a committed workforce is more likely to be facilitated by the employment of sophisticated human resource management infrastructures. Arguably according to Schuler and Jackson (1987) human resource management policies and practices can be strategically designed and installed to promote desirable employee outcomes, which include the enhancement of their role and behaviour. Yet, despite such acknowledgements, organizations and management often time lack the commitment to improve and cement the linkage between employees and their organizations.
4.5 The Influence of Financial Resources on Aviation Safety

A five point Likert scale was used by the respondents to indicate the extent to which financial resources influenced aviation safety in Kenya. The rating scales were: 1 = Strongly disagree, 2 = Disagree, 3 = Neutral, 4 = Agree and 5 = Strongly agree. The mean and standard deviations were generated from SPSS and are as illustrated in Table 4.7 showing the relationship between the independent and dependent variable.

Table 4.5: Mean and standard deviations for Financial Resources and Aviation Safety

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>The organization is sufficiently funded to effectively carry out its mandate of safety oversight.</td>
<td>3.7631</td>
<td>0.71116</td>
</tr>
<tr>
<td>The organization has employed mechanism to ensure adequate financial sustainability.</td>
<td>4.2178</td>
<td>0.67891</td>
</tr>
<tr>
<td>The organization’s funds are made available to the critical safety oversight functions adequate.</td>
<td>3.0966</td>
<td>0.84955</td>
</tr>
<tr>
<td>Relevant personnel are involved in the budget planning of the organization</td>
<td>4.0846</td>
<td>0.92804</td>
</tr>
<tr>
<td>Mechanisms have been put in place to discourage funds misappropriation.</td>
<td>3.0690</td>
<td>0.05426</td>
</tr>
</tbody>
</table>

The responses pointed out that the organization has employed mechanism to ensure adequate financial sustainability as this parameter had the highest mean score of 4.2. The results also pointed out that the organization is sufficiently funded to effectively carry out its mandate of safety oversight as this parameter also scored a high mean score of 3.71. The study revealed faults in the implementation of the safety procedures as the respondents were concerned about the availability of funds in time of need. The respondents were discontented with the fact that the funds were not made readily available to the critical safety oversight functions as this parameter had a low mean score of 3.07, this is despite the fact that the respondents felt that the relevant personnel were involved in the budget planning of the organization with a
response mean score of 4.086. Such a scenario may indicate that the resource allocation and priority setting is wanting hence compromising the aviation safety at KCAA. The respondents felt that there are loopholes which would lead to funds misappropriation as this parameter scored a low mean score of 3.08.

These findings conform to a study conducted by Browman, (2009) who indicates that financial resource allocation and priority setting are challenging issues faced by aviation safety decision makers requiring careful consideration of many factors, including objective such as reason, and subjective like empathy elements. This has not only opened up a window for fraud but also funds misappropriations as implied by the low mean score of 3.0. As Oncol, (2008) argues, choices may not be based on rational and transparent processes highlighting the need for processes that take this into account. He emphasizes that if the mechanism employed to guide the distribution of financial resources is inequitable, the outcome is also likely to be the same hence compromising aviation safety.

4.6 The Influence of Infrastructure on Aviation Safety

A five point Likert scale was used by the respondents to establish the extent to which aviation infrastructure influence aviation safety in Kenya. The rating scales were: 1 = Strongly disagree, 2 = Disagree, 3 = Neutral, 4 = Agree and 5 = Strongly agree. The mean and standard deviations were generated from SPSS and are as illustrated in Table 4.8 showing the relationship between the independent and dependent variable.
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Mean</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>The aerodrome ground infrastructure is adequate for the current aviation activities in the country.</td>
<td>2.2000</td>
<td>0.84690</td>
</tr>
<tr>
<td>Planning and implementation of the civil aviation infrastructure is methodically integrated into the civil aviation system.</td>
<td>2.9000</td>
<td>0.95953</td>
</tr>
<tr>
<td>The technology supporting civil aviation air traffic system is adequate and up to date.</td>
<td>3.6767</td>
<td>0.90873</td>
</tr>
<tr>
<td>The layout of pavements for movement of aircraft at aerodromes supports safe increase of airport throughput.</td>
<td>3.1241</td>
<td>0.83094</td>
</tr>
<tr>
<td>Effective regulatory system to ensure control of developments around civil aerodromes to guard against encroachment</td>
<td>2.7379</td>
<td>0.94219</td>
</tr>
<tr>
<td>The ICAO runway safety programme been implemented in the entire aerodrome where it applies.</td>
<td>3.0690</td>
<td>0.94982</td>
</tr>
<tr>
<td>International standard relating to aerodrome certification are comprehensively complied with.</td>
<td>3.5966</td>
<td>0.84955</td>
</tr>
<tr>
<td>Aerodromes’ infrastructure maintenance practices or programmes are adequate to ensure sustained availability and compliance with international standards.</td>
<td>3.0690</td>
<td>0.05426</td>
</tr>
<tr>
<td>The National government and/or the County Government have an impact on airport operations especially in urban planning.</td>
<td>3.0846</td>
<td>0.92804</td>
</tr>
<tr>
<td>National plans integrate well with the Airport master plans.</td>
<td>3.0690</td>
<td>0.05426</td>
</tr>
</tbody>
</table>
Responses obtained from the survey revealed that the technology supporting civil aviation air traffic system is fairly adequate and up to date as this parameter had the highest mean score of 3.6767. The respondents felt that the international standard relating to aerodrome certification were comprehensively complied with at the KCAA as this parameter had a mean score of 3.5. The standard of air traffic system infrastructure in KCAA was questionable as the parameters scored low mean scores with parameters such as the layout of pavements for movement of aircraft at aerodromes dimmed not to support safety and increase of the airport throughput as this parameter had a low mean score of 3.1. Other infrastructural parameter that had very low mean scores were the; adequacy of the aerodrome ground infrastructure with a mean score of 2.2, the methodological integration of the planning and implementation of the civil aviation infrastructure with a mean score of 2.9. County governments in the vicinity of the airports should take a more proactive approach to curb encroachment around airports designated land as this parameter had a mean score of 3.08 indicating that this was an area of concern with regard to safety. It was also noted that the national and airport master plan integration which scored a mean of 3.069, and the failure of the KCAA to ensure full implementation of the ICAO runway safety program entirely at aerodromes where it applies were an impediment to safety.

The study indicates that both the soft and hard components of infrastructure have shortcomings hence compromising aviation safety. This is evident from the low mean scores in parameters such as the layout of pavements for movement of aircraft at aerodromes which do not support safe increase of airport throughput and policy elements such as the inadequacy of Aerodromes’ infrastructure maintenance practices or programmes in order to ensure sustained availability and compliance with international standards. According to Ali and Pernia (2003) infrastructure consists of hard and soft components. They further indicate that the hard and visible infrastructure, such as roads, railways, electricity, and telecommunications, must be accompanied and supported by its soft component, such as policies and regulations, to enable the system to perform well and generate impacts. Both these are inadequately addressed at the KCAA as the parameters measuring them scored very low mean scores in a five point scale. This case is however not peculiar as other studies such as the report by Ncube (2012), which reiterates that the air transport industry faces various
challenges including poor airport infrastructures, lack of physical and human resources, limited connectivity, and lack of transit facilities. He further indicates that although substantial progress has been made during the past decade, Africa still lags behind other regions in terms of “soft” and “hard” infrastructure.

4.7 Influence of Technical Guidance Material (TGM) on Aviation Safety

A five point Likert scale was used by the respondents to examine how technical guidance material influence aviation safety in Kenya. The rating scales were: 1 = Strongly disagree, 2 = Disagree, 3 = Neutral, 4 = Agree and 5 = Strongly agree. The mean and standard deviations were generated from SPSS and are as illustrated in Table 4.9 showing the relationship between the independent and dependent variable.

Table 4.7: Mean and standard deviations for Technical Guidance Material (TGM) on Aviation Safety

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Mean</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>TGMs are vital tools in enhancing safety.</td>
<td>4.2586</td>
<td>0.94982</td>
</tr>
<tr>
<td>Employees are provided with adequate guidance material to effectively carry out their functions.</td>
<td>4.6971</td>
<td>0.84955</td>
</tr>
<tr>
<td>The existing TGMs are well laid out and easy to follow.</td>
<td>4.3321</td>
<td>0.92804</td>
</tr>
<tr>
<td>The TGMs in your domain are up-to-date.</td>
<td>3.7516</td>
<td>0.05426</td>
</tr>
<tr>
<td>Recommended revisions on TGMs are promptly implemented.</td>
<td>2.7931</td>
<td>1.00160</td>
</tr>
<tr>
<td>The management is committed to the implementation of provisions laid out in the TGMs.</td>
<td>4.0690</td>
<td>0.94982</td>
</tr>
<tr>
<td>The existing TGMs are in tandem with the current practices and technology.</td>
<td>4.8966</td>
<td>0.84955</td>
</tr>
<tr>
<td>The applicability of the existing TGMs is matching with the intended operations.</td>
<td>4.7241</td>
<td>0.83094</td>
</tr>
</tbody>
</table>
Responses obtained from the study revealed that the existing TGMs are in tandem with the current practices and technology as this parameter scored the highest mean score of 4.8. This may be due to the fact that these materials are developed by ICAO which is well equipped both technically and financially to establish research based on standards and recommend policies. The respondents also felt that the applicability of the existing TGMs was matching with the intended operations as this parameter scored a very high mean score of 4.72.

The respondents agreed to the fact that employees were provided with adequate guidance material to effectively carry out their functions which were well laid out and easy to follow as these parameters scored means of 4.6 and 4.2 in each case. The respondents were in unison to the fact that TGMs were vital tools in enhancing safety as this parameter had a mean score of 4.2586. Some of the respondents felt that the TGMs in their domain were up-to-date with some having a contrary opinion as this parameter experienced some skewness scoring a mean of 3.7. The respondents however felt that recommended revisions on TGMs were not promptly implemented as this parameter had the lowest mean score of 2.7.

The study revealed that the recommended revisions on TGMs were not promptly implemented. Delay or failure to implement recommendations could lead to a compromise on safety as users would be applying the wrong procedures. The importance of having up-to-date Technical Guidance Material cannot be over-emphasized and is reverberated by the U.S Environmental Protection Agency (2012) which states that the effectiveness of a safety oversight system and the implementation of national and international standards need to be supported by guidance material which will provide the technical experts with guidance on how to accomplish their specific functions. The same sentiments were underscored during the 11th meeting of the Air Transport Regulation Panel (ATRP/11) held in Montreal, Canada on June 2012, which noted that while ICAO guidance and policies remained relevant, there was a lack of awareness to some extent and implementation by States.
4.8 Summary of Descriptive Statistics of the Constructs

Since a single construct in the questionnaire was measured by multiple items, the average score of the multi-items for a construct was computed and used in further analysis in this linear Regression analysis as illustrated in Table 4.10.

<table>
<thead>
<tr>
<th>Construct</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical Guidance Material</td>
<td>50</td>
<td>4.19027</td>
<td>0.63478</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>50</td>
<td>2.98336</td>
<td>0.59485</td>
</tr>
<tr>
<td>Financial resources</td>
<td>50</td>
<td>3.64622</td>
<td>0.63700</td>
</tr>
<tr>
<td>Professional qualifications</td>
<td>50</td>
<td>3.07161</td>
<td>0.63805</td>
</tr>
</tbody>
</table>

To construct the final data set, the researcher merged the aggregated survey data set based on the means of responses. In general; the mean score for the items in the constructs (technical guidance material, infrastructure, financial resources and professional qualifications) were average ranging from 4.1 to 2.9 on a five point Likert scale. In order to determine the effect of each variable on the dependent variable a Pearson’s correlation and linear regression analysis were conducted.

According to Table 4.10, there is a positive relationship between aviation safety and technical guidance material, aviation infrastructure, financial resources and personnel professional qualifications of magnitude 0.635, 0.595, 0.637 and 0.638 respectively. The positive relationship indicates that there is a correlation between the factors influencing aviation safety policies and objectives at the Kenya Civil Aviation Authority with technical guidance material, financial resources and professional qualifications variables having the highest value while aviation infrastructure having the lowest correlation value.

4.9 Bivariate Correlation

Correlation is used to determine the strength of relationship between dependent and independent variables. Correlation value of 0.0 shows no relationship between the
independent and dependent variable whereas when the value is not or equal to 1.0, there is a perfect negative or positive relationship respectively. Values shall be interpreted between 0.0 (no-relationship) and 1.0 (perfect relationship) (Levin & Rubin, 2008).

Table 4.9: Relationship between the Dependent Variable and the Independent Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Correlation</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical Guidance Material</td>
<td>0.590</td>
<td>0.001</td>
</tr>
<tr>
<td>Aviation Infrastructure</td>
<td>0.303</td>
<td>0.000</td>
</tr>
<tr>
<td>Financial resources</td>
<td>0.410</td>
<td>0.008</td>
</tr>
<tr>
<td>Professional qualifications</td>
<td>0.257</td>
<td>0.003</td>
</tr>
</tbody>
</table>

The total number of respondents in this study as indicated by the N values was 50. All the tested variables were significant as all of them had a p value of less than 0.05. From the correlation analysis it can be noted that technical guidance material had the highest predictor value with a correlation value of 0.590, infrastructure had a correlation value of 0.303 and financial resources had a positive correlation value of 0.410. The smallest predictor of aviation safety was professional qualifications with a correlation value of 0.257. According to Table 4.11, all the factors had a significant p-value (p<0.05). The significance values for relationship between aviation safety in Kenya and technical guidance material, aviation infrastructure, financial resources and personnel professional qualifications influence were 0.001, 0.000, 0.008 and 0.003 respectively. This implies that aviation infrastructure had the highest significant factor, followed by technical guidance material, professional qualification and financial resources respectively.
CHAPTER FIVE
SUMMARY OF THE FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction
This chapter discusses and provides a summary of the findings from chapter four and gives the conclusions and recommendations of the study based on the objectives of the study. The overall objective of this study was to establish the factors influencing aviation safety, a case of the Kenya Civil Aviation Authority.

5.2 Summary of the Findings
5.2.1 The Findings on the influence of Personnel Professional qualification on aviation safety
The study established that personnel professional qualifications have a major effect on aviation safety at the KCAA as the Authority had inadequate qualified technical inspectors and technical safety staff in the safety management system. The study also revealed that the percentage of training execution in the organization was low as the organization did not appear to be adequately committed towards staff development. The recruitment and retention policy were not efficient and it had a negative effect on the morale of the safety officers subsequently compromising the overall safety of the industry. On a positive note, the study revealed that working environment was dimmed conducive and the organization had sufficient plans to implement new technologies based on emerging trends by identifying and managing threats to aviation operations.

5.2.2 The Findings on the influence of Financial Resources on aviation safety
The study ascertained that other than the organization being well funded, it has employed mechanism to ensure adequate financial sustainability by investing in efficient systems that will aid them in the collection, attracting and retaining of funds collected. The study also revealed that the relevant personnel were involved in the overall budget planning in the organization with all the stakeholders being involved.
The study however revealed that there was a bottleneck in the financial system and procedures as the organization’s funds were not made readily available to the critical safety oversight functions, a factor that has a significant impact on the airport safety and security. The respondents were not contented with the fraud and funds misappropriation prevention mechanisms in place as they felt it had loopholes that could lead to fraud/misappropriation of funds.

5.2.3 The Findings on the Influence of Infrastructure on Aviation Safety
As far as airport infrastructure was concerned, the study revealed that the technology supporting civil aviation air traffic system was dimmed adequate and up to date as the KCAA complied with international standard relating to aerodrome certification. The study also revealed that the ICAO runway safety program had not been entirely implemented in the aerodromes as the infrastructure maintenance practices were inadequate. The national government and county governments also contributed negatively to airport safety as they lacked effective regulatory system to ensure control of developments around civil aerodromes, to guard against encroachment.

The study also established that planning and implementation of the civil aviation infrastructure was not methodically integrated into the civil aviation system, contributing to inadequacy of aerodrome ground infrastructure for the current aviation activities in the country.

5.2.4 The Findings of Technical Guidance Material on Aviation Safety
There was a unanimous consent that technical guidance material had a positive effect on aviation safety as this parameter experienced the highest correlation score with the dependent variable. The responses obtained revealed that the existing TGMs were in line with the current practices and technology and the employees were provided with adequate guidance material to effectively carry out their functions in an effort to increase airport safety.

The applicability of the existing TGMs was matching with the intended operations as they were well laid out and easy to follow. The major impediment of aviation safety as far as
TGMs were concerned was the prompt implementation of the recommendations, a factor that can be traced back to the moderating variables such as government and aviation policies and procedures.

5.4 Conclusions
The study concludes that personnel professional qualifications are a major contributor to aviation safety due to the fact that the aviation industry is technical based with rapidly changing technologies, applications and emerging issues. Recruitment and retention policies need to be prioritized in order to attract the appropriate personnel based on the organization needs. Failure to do so may compromise service delivery and Kenya’s aviation safety record.

The study concludes that mechanisms in place to ensure financial sustainability have a positive effect on aviation safety as the organization has financial reserves that can be used in time of crisis. The study also concludes that funds allocation mechanism has a significant impact on aviation safety since they were not made readily available to the critical safety oversight functions. Further the study highlights that resources in the aviation industry are limited hence the need to optimize and prioritize them in order to reduce wastage and discourage funds misappropriation.

The overall infrastructure in Kenya is wanting and hence has a great effect on aviation safety. Components ranging from aerodrome ground infrastructure, air traffic management system, layout of pavements and infrastructure maintenance practices are ineffective hence compromising aviation safety. The study concludes that the relevance of the existing TGMs is in line with the current practices in the aviation industry, however, recommended revisions should be implemented as soon as possible.

5.5 Recommendations
i) The study recommends that KCAA should carry out a needs assessment analysis of its technical and safety oversight personnel in order to establish strategies to bridge the human resource gap.
ii) The KCAA should also initiate a motivation and retention programme in order to curb the migration of personnel to other States and industries that are likely to be offering more competitive employment packages.

iii) Existing training facilities including classrooms, training aids such as simulators and learning laboratories instructors and information technology should be modernized in order to conform to the ICAO set standards of operation.

iv) In order to curb the resource allocation deficiency in the aviation industry, the study recommends that KCAA should consider efficiency, fairness and utility when allocating resources needed to improve airport safety as this will guide them when faced with quagmires arising from empathy elements.

v) KCAA should deploy mechanisms to effectively detect fraud and funds misappropriation which should be in line with the public procurement oversight authority’s laid down procedures for accountability.

vi) It also recommends that the airport safety zones should be clearly demarcated and communicated to the national government under the Ministry of Lands as well as the Ministry of Transport and Infrastructure who in turn should act swiftly to stop further developments and remove illegal developments along the airports.

vii) In an effort to improve on the implementation effectiveness of provisions and policies set by ICAO, the study recommends a more collaborative association between KCAA and ICAO in order to develop and publish their own tailor-made technical guidance material to assist their technical experts in implementing national regulations, procedures and practices.
5.6 Suggestions for Further research

i) From the study and related conclusions, the study gives suggestions for further research in the area of utilization and penetration of emerging technology in order to improve aviation safety and security.

ii) The study also suggests further research studies to establish the impact of terrorism on aviation security in Kenya.

iii) It would also be of interest to establish the influence of air operators and air service providers on aviation safety.
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APPENDICES

Appendix I: Letter of Transmittal

Esther Waithera Njeru
P. O. Box 46294-00100
Nairobi, Kenya
Email: estin04@yahoo.com

15 June 2015

To Whom It May Concern

Ref: Letter of Introduction of Researcher to Respondents

Dear Sir/Madam,

My name is Esther Waithera Njeru, a student at the University of Nairobi undertaking a degree in Masters of Arts in Project Planning and Management. In fulfilment of the requirements for the degree, I am currently conducting research on “Factors influencing Aviation Safety in Kenya: The Case of Kenya Civil Aviation Authority.”

I am therefore kindly requesting for your cooperation to enable me gather the necessary information. I wish to assure you that your views will be treated with utmost confidentiality and the research is purely for pedagogical purposes only. This survey is completely voluntary and anonymous.

Your participation and inputs will be of great help to not only facilitating completion of my studies but also provide insights as to what needs to be done in order to improve aviation safety in Kenya.

Attached please find a questionnaire which I kindly request you to provide the required information and if possible provide feedback within a week. My research assistant will collect the questionnaire after one week.

Yours faithfully,

Esther Waithera Njeru
Student No.L50/63493/2010
Appendix II: Questionnaire

This questionnaire is designed to assist in collection of data on the factors influencing aviation safety in Kenya. The information revealed by the respondents will be treated with a high degree of confidentiality. The respondents are also assured that this information is meant for academic purposes only.

Kindly fill in the following by ticking (✓) your response and in the case of open ended questions kindly provide your brief comments.

PART I: Background Information

1. Gender:  Female ( )   Male ( )

2. Department:

<table>
<thead>
<tr>
<th>Department</th>
<th>Please tick (✓)</th>
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</thead>
<tbody>
<tr>
<td>Aerodrome and Ground Aids Inspectors</td>
<td></td>
</tr>
<tr>
<td>Meteorology and Aeronautical Inspector</td>
<td></td>
</tr>
<tr>
<td>Air Navigation Services and Search and Rescue</td>
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<tr>
<td>Communication Navigation and Surveillance</td>
<td></td>
</tr>
<tr>
<td>Flight Operations</td>
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<tr>
<td>Aircraft Airworthiness</td>
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<tr>
<td>Personnel Licensing</td>
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<tr>
<td>Aviation Security and Facilitation</td>
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</tr>
</tbody>
</table>

3. Years served:

   Less than 1 Year ( )   1-5Years ( )   5 and above Years ( )

4. Level of Education:

   i. Certificate
   ii. Advanced Certificate
iii. Diploma □
iv. University - Bachelor’s Degree □
v. University - Master’s Degree □

Other (Specify) ______________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

Part II: Qualified Personnel and Aviation Safety

<table>
<thead>
<tr>
<th>Question</th>
<th>(5) Excellent</th>
<th>(4) Above Average</th>
<th>(3) Average</th>
<th>(2) Below Average</th>
<th>(1) Poor</th>
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</thead>
<tbody>
<tr>
<td>1. The number of qualified safety inspectorate staffs adequate in your</td>
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<tr>
<td>department.</td>
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<tr>
<td>2. The number of qualified technical safety staff in the safety</td>
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<tr>
<td>management system</td>
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<tr>
<td>3. Effectiveness of methods used to determine adequate staff requirements.</td>
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<td>4. The organization’s personnel who are deployed to provide flight</td>
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<td>safety oversight are sufficiently qualified.</td>
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<tr>
<td>5. Training offered is innovative and responsive to the needs of the</td>
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<td>aviation industry.</td>
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<td>6. The percentage of training execution in the organization</td>
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<tr>
<td>7. Your assessment of the organization’s commitment to staff development</td>
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<tr>
<td>8. The working environment is conducive to personnel.</td>
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<tr>
<td>9. The extent to which inspectorate staff is empowered to carry out its</td>
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<tr>
<td>job including resolution of safety concerns.</td>
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</tbody>
</table>
10. Your overall assessment of opportunities for development in your department.

11. The organization plans for new technologies based on emerging trends, identifies and manages threats to aviation operations.

12. Your organization have an effective recruitment and retention policy that include employee benefits

13. Requests for training are effectively addressed by the relevant department in-charge of training

In your view what can be done by the organization in order to attract and retain appropriately qualified and experienced technical staff?

_________________________________________________________________________________

_________________________________________________________________________________

_________________________________________________________________________________

Part III: Financial Resources and Aviation Safety

<table>
<thead>
<tr>
<th>Question</th>
<th>(5) Strongly Agree</th>
<th>(4) Agree</th>
<th>(3) Neutral</th>
<th>(2) Disagree</th>
<th>(1) Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>14. The organization is sufficiently funded to effectively carryout its mandate of safety oversight.</td>
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<tr>
<td>15. The organization has employed mechanism to ensure adequate financial sustainability.</td>
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</tbody>
</table>
16. The organization’s funds are made available to the critical safety oversight functions adequate.

17. Relevant personnel are involved in the budget planning of the organization.

18. Mechanisms have been put in place to discourage funds misappropriation.

Do you have any suggestion as to what measures the organization can undertake to improve its financial health?

_________________________________________________________________________________
_________________________________________________________________________________
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Part IV: Aviation Infrastructure and Aviation Safety

<table>
<thead>
<tr>
<th>Question</th>
<th>(5) Strongly Agree</th>
<th>(4) Agree</th>
<th>(3) Partly Agree</th>
<th>(2) Disagree</th>
<th>(1) Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The aerodrome ground infrastructure adequate for the current aviation activities in the country.</td>
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<tr>
<td>2. Planning and implementation of the civil aviation infrastructure is methodically integrated into the civil aviation system.</td>
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<tr>
<td>3. The technology supporting civil aviation air traffic system is adequate</td>
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</table>
and up to date.

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</thead>
<tbody>
<tr>
<td>4.</td>
<td>The layout of pavements for movement of aircraft at aerodromes support safe increase of airport throughput.</td>
<td></td>
<td></td>
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<tr>
<td>5.</td>
<td>There is an effective regulatory system to ensure control of developments around civil aerodromes to guard against encroachment that might be detrimental to safe use of the aerodrome.</td>
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<tr>
<td>6.</td>
<td>The ICAO runway safety programme been implemented in the entire aerodrome where it applies.</td>
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<tr>
<td>7.</td>
<td>International standard relating to aerodrome certification are comprehensively complied with.</td>
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<tr>
<td>8.</td>
<td>Aerodromes’ infrastructure maintenance practices or programmes are adequate to ensure sustained availability and compliance with international standards.</td>
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<tr>
<td>9.</td>
<td>The National government and/or the County Government have an impact on airport operations especially in urban planning.</td>
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<tr>
<td>10.</td>
<td>National plans integrate well with the Airport master plans.</td>
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</tbody>
</table>
11. Please indicate any three issues that may need to be addressed in order to improve aviation infrastructure in Kenya

1. ____________________________________________________________
   ___________________________________________________________________________________
   ___________________________________________________________________________________
   _________________________________________________________________

2. ____________________________________________________________
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   _________________________________________________________________

3. ____________________________________________________________
   ___________________________________________________________________________________
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   _________________________________________________________________

Part V: Technical Guidance Material (TGM) and Aviation Safety

<table>
<thead>
<tr>
<th>Question</th>
<th>(5) Strongly Agree</th>
<th>(4) Agree</th>
<th>(3) Partly Agree</th>
<th>(2) Disagree</th>
<th>(1) Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. TGMs are vital tools in enhancing safety.</td>
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<td>2. Employees are provided with adequate guidance material to effectively carry out their functions.</td>
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<tr>
<td>3. The existing TGMs are well laid out and easy to follow.</td>
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<td>4. The TGMs in your domain are up-to-date.</td>
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<td>5. Recommended revisions on TGMs are promptly implemented.</td>
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</tbody>
</table>
6. The management is committed to the implementation of provisions laid out in the TGMs.

7. The existing TGMs are in tandem with the current practices and technology.

8. The applicability of the existing TGMs are congruent with the intended operations.

15. Please list 3 issues that you think affects efficiency and continuity of aviation operations in Kenya due to inadequacy of technical guidance materials.

1________________________________________________________________________________
________________________________________________________________________________
________________________________________________________________________________

2________________________________________________________________________________
________________________________________________________________________________
________________________________________________________________________________

3________________________________________________________________________________
________________________________________________________________________________
________________________________________________________________________________

Thank you for taking time to complete the questionnaire
Appendix III: Introduction Letter from the University of Nairobi

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

Your Ref:
Main Campus
Gandhi Wing, Ground Floor
P.O. Box 30197
NAIROBI

Our Ref:
Telephone: 318262 Ext. 120

17th June, 2015

REF: UON/CEES//NEMC/21/224

TO WHOM IT MAY CONCERN

RE: ESTHER WAITHERA NJERU - L50/63493/2010
This is to confirm that the above named is a student at the University of Nairobi, College of Education and External Studies, School of Continuing and Distance Education, Department of Extra-Mural Studies pursuing Master of Arts in Project Planning and Management.

She is proceeding for research entitled “factors influencing aviation safety in Kenya”.
The case of Kenya Civil Aviation Authority.

Any assistance given to her will be appreciated.

CAREN AWILLY
CENTRE ORGANIZER
NAIROBI EXTRA MURAL CENTRE
Appendix IV: Research Permit

THIS IS TO CERTIFY THAT:

MS. ESTHER WAITHERA NJERU
of UNIVERSITY OF NAIROBI, 0-100
Nairobi, has been permitted to conduct
research in Nairobi County

on the topic: FACTORS INFLUENCING
AVIATION SAFETY IN KENYA THE CASE
OF KENYA CIVIL AVIATION AUTHORITY

for the period ending:
4th December, 2015

Applicant's
Signature

Director General
National Commission for Science, Technology & Innovation

CONDITIONS

1. You must report to the County Commissioner and
the County Education Officer of the area before
embarking on your research. Failure to do that
may lead to the cancellation of your permit.
2. Government Officers will not be interviewed
without prior appointment.
3. No questionnaire will be used unless it has been
approved.
4. Excavation, filming and collection of biological
specimens are subject to further permission from
the relevant Government Ministries.
5. You are required to submit at least two (2) hard
copies and one (1) soft copy of your final report.
6. The Government of Kenya reserves the right to
modify the conditions of this permit including
its cancellation without notice.
Appendix V: Authorization Letter

NATIONAL COMMISSION FOR SCIENCE,
TECHNOLOGY AND INNOVATION

Telephone: +254-20-2213471,
2241349, 310571, 2219420
Fax: +254-20-318245, 318249
Email: secretary@nacost.go.ke
Website: www.nacost.go.ke
When replying please quote

Ref: No.
Date:
20th July, 2015

NACOSTI/P/15/8200/6777

Esther Waithera Njeru
University of Nairobi
P.O. Box 30197-00100
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on “Factors influencing aviation safety in Kenya the case of Kenya Civil Aviation Authority,” I am pleased to inform you that you have been authorized to undertake research in Nairobi County for a period ending 4th December, 2015.

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

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

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

Copy to:
The Director General
Kenya Civil Aviation Authority.
The County Commissioner
Nairobi County.