CHALLENGES IN DEVELOPMENT AND IMPLEMENTATION OF INFORMATION SYSTEMS IN ADHOC LANDING AND OVERFLIGHT CLEARANCES IN THE KENYAN AIRSPACE

BY

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A MANAGEMENT RESEARCH PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF BUSINESS ADMINISTRATION, SCHOOL OF BUSINESS, UNIVERSITY OF NAIROBI.

OCTOBER 2012

DECLARATION

This research project is my original work and has not been presented for award of any degree in any University.

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DEDICATION

This work is dedicated to my mother, Anna Nthambi, my father, Joshua Kitavi and my siblings, Ken Kivuva, Leonard Kivuva and Carol Kivuva. They have all been a great source of inspiration and strength to me.

ACKNOWLEDGEMENTS

My foremost gratitude is to the almighty God for the opportunity to undertake this study and for giving me the strength, health and determination to complete the requirements for the award of the Degree of Master of Business Administration.

I am deeply indebted to my supervisor J. T. Kariuki for his invaluable guidance throughout the research project. He had keen interest in the work and dedicated his valuable time to supervise and guide me from the beginning to the end. Mr. J. Lelei dedicated his time to moderate this project and I would like to appreciate his guidance, the time and commitment he dedicated to my work.

Sincere appreciation also goes to the management of KCAA for allowing me to base this study on the organization. I would also like to thank my colleagues at work who accorded me time to study and cover for me while on leave working on my research project.

Lastly, to my fellow classmates and friends, it is a gigantic thank you.

ABSTRACT

Information Systems are computer based infrastructures, organizations, people and components that pull together, process, store, transmit, present, disseminate and act on information. Use of information systems in many organizations has increased across all industries. Information systems have evolved over the years to match up with changes in organizational challenges from being simply operational tools to being used for strategic purposes. Governments are also embracing information systems by using them to deliver quality services and give access to important information. However, despite usage of information systems, their implementation faces many challenges which vary from context to context. These challenges have contributed to high failure rate in development and implementation of information systems. The failure rate is higher is Government institutions. Nevertheless, the Kenya Civil Aviation Authority (KCAA) successfully implemented the Advanced Air Transport Information System (AATIS) which fully automated the processing of landing and overflight clearances within the Kenyan Airspace. The objective of this study was to establish the challenges that were faced during the development and implementation of the AATIS.

The main instrument of data collection was a structured questionnaire that was administered to officers who were involved in the development and implementation of the AATIS. Out of the 32 questionnaires administered, 29 were responded to giving a response rate of 91%. The data was analyzed using descriptive statistics and content analysis to help in drawing comparisons and conclusions. It was established that the key challenges in the development and implementation of the AATIS were bureaucracies in Government projects, organizational politics, slow procurement processes, schedule overruns, poor change management practices, poor requirements management, inability to retain technical staff, poor attitudes towards quality improvement, poor IT infrastructure specifically in internet services, WAN connectivity and computers, conflicts between user departments and regulatory frameworks. Effective implementation of the performance contracts between the Ministry of Transport and the KCAA Board of Directors and its cascading to the individuals resolved these challenges. The study drew

the following conclusions; proper implementation and evaluation of performance contracts between parent ministries and the heads of Government Institutions will increase the levels of automation in Kenyan Government institutions. In aviation regulation, incorporating computerized information systems in audits from international bodies like ICAO and FAA will increase the levels of automation in KCAA and other CAAs.

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AATIS	Advanced Air Transport Information System
AIS	Aeronautical Information Services
AOC	Air Operator Certificate
ASL	Air Service License
ATC	Air Traffic Control
ATS	Air Traffic Services
BASA	Bilateral Air Service Agreement
CASSOA	Civil Aviation Safety and Security Oversight
COA	Certificate of Air Worthiness
COR	Certificate of Registration
CSF	Critical Success Factors
EAC	East African Community
EASA	East African School of Aviation
ICAO	International Civil Aviation Organization
ICT	Information Communication and Technology
IS	Information Systems
IT	Information Technology
ITC	Interactive Tour Charter
JKIA	Jomo Kenyatta International Airport
KAA	Kenya Airports Authority
KCAA	Kenya Civil Aviation Authority
MIA	Moi International Airport
SARP	Standard and Recommended Practice

CHAPTER ONE

INTRODUCTION

1.1 Background

Information Systems are computer based infrastructures, organizations, people and components that pull together, process, store, transmit, present, disseminate and act on information (Silberberg & Mitzel, 2005). Use of information systems in many organizations has increased across all industries. Information systems have evolved over the years to match up with changes in organizational challenges from being simply operational tools to being used for strategic purposes. They are now main drivers of business (Mutai, 2010). Computers no longer merely provide the backbone of organizations' information processing but they are shifting the fundamental ways in which organizations operate (Peterson & Kim, 2000). Organizations today face the stark reality of anticipating, responding and reacting to the growing demands of the marketplace or perish (Nyaga, 2006). Effective business and operational strategy is now centered on efficient and aggressive use of information systems.

In today's Organizations, information systems are developed and implemented depending on the business requirements to be fulfilled and the type of users expected (Kendall & Kendall, 2006). Transaction based systems are large information systems that are developed for processing large amounts of data and routing transactions. They lessen the total time required to execute these transactions as well as improving the quality of output. Office automation systems support data workers who do not create new knowledge. These comprise of spreadsheets, word processors, desktop publishing and communications applications like email. Management information systems contain within themselves transaction processing systems. They require hardware, software and people to work together to accomplish tasks that go beyond the spectrum of ordinary transaction processing systems. According to Kendall and Kendall (2006), decision support systems, just like management information systems obtain their data from a

database. However, their main difference from traditional information systems is that they support decision making in all their phases. Decision support systems are interactive, computer based information systems that use decision models and specific databases to support the decision making process of managerial end users (Obrien, 1999). Expert systems are considered to behave intelligently by reasoning through a problem to its logical conclusion. They replicate human reasoning by combining a knowledge base and inference rules that establish how the knowledge is applied (Shelly et al, 2008).

Computer based information systems have decreased operating overheads, changed the way of doing business, created new opportunities for organizations and narrowed the gap between businesses and clients (Borura, 2009). Governments are also embracing information systems by using them to deliver quality services and give access to important information. The Kenyan Government through the Kenya Information and Communications act of 2006 established policies, frameworks and procedures that support and drive use of information systems as well as incorporating them in development agenda. Kenyan Parastatals are increasingly implementing information systems to provide better services and increase transparency and accountability in their processes.

1.1.1 Development and Implementation of Information Systems

Given the increasing importance of information systems to economic growth, enhancing the quality of services and increasing competitive advantage, methodologies and experiences of developing information systems have also advanced tremendously. Organizations are investing heavily in information systems development and implementation. Kroenke (2010) defined information systems development as the process of creating and maintaining information systems encompassing hardware, software, data, people and processes. Ralph and Reynolds (2008) cited that effective and efficient information systems development requires a team effort of stakeholders, managers, users, system development specialists and various support personnel. This process should only start after careful planning to ensure that specific system development objectives support organizational objectives.

Due to the complicated nature of systems development, structured methodologies and tools should be used to ensure success. With increase usage and of information systems, their requirements and design have become complex and therefore, developing them using unstructured methods will likely lead to failure (Kroenke, 2010). Structured methodologies emerged in the early 70's and they are normally employed in development and implementation of information systems. According to Kendall and Kendall (2006), the earliest known structured method for development of information systems is the system development lifecycle (SDLC). It has five stages namely; system definition, requirements analysis, component design, implementation and system maintenance. The number of stages in the lifecycles varies from author to author. Implementation of Information Systems is usually one of the latter stages in the System development lifecycle. Kroenke (2010) defined it as putting the best solution into effect. It entails acquiring any required hardware or software, integrating all the components required in the information system to work together, training users and installing the new or modified system into production environment.

Ralph and Reynolds (2008), O'Brien (2007) and Kendall and Kendall (2006) summarized the entire process into two major stages; development and implementation. Development covers system conceptualization, system requirements and benefits analysis, project adoption and project scoping, system design, specification of software requirements, architectural design, detailed design, unit development, integration and testing. Then implementation of the already built or acquired solution entails installation at site, customization, data migration and conversion, user acceptance testing, end user and technical training, documentation, system conversion (system change over) to live environment and maintenance. The structured waterfall methodology posed some challenges because it was not possible to go to some of the previous stages for review or changes. As a result, other information system development methodologies emerged which allow continuous feedback and control. These methodologies are; prototyping, rapid application development, end-user development, computer-aided software engineering and object oriented development (O'Brien, 2007).

1.1.2 Challenges in Development and Implementation of Information Systems

Given the increasing importance of information systems to economic growth and increasing competitive advantage, methodologies and experiences of developing information systems have also advanced tremendously. Organizations are investing heavily in information systems implementation. However, despite the proliferation of information systems in all sectors of the economy, their development and implementation still remains a challenging and an uncertain process (Peterson & Kim, 2000). According to a study done by Magutu et al (2010), the main challenges in implementation of information systems are in; process and structure, procurement and communication, information systems design and people management, corruption, technical and systems tuning. These challenges also contribute to information systems implementation failure. A study done by Heeks (2002) categorized information systems failure into three parts; total failure, partial failure and sustainability failure. The rate of the three types of failures is higher in developing Countries than in developed Countries. This high failure rate in developing Countries is as a result of information systems design and actual usage gaps in processes, resources, technology and infrastructure. Borura (2009) cited that in Kenya, State corporations have a higher failure rate in implementation of information systems compared to private organizations. This failure is caused by a number of factors which include; complicated and stiff procurement procedures, corruption, political pressures, rigid institutional frameworks and inflexible hiring and rewarding procedures. Computer based information systems also take too long to develop and implement. In addition, user departments voice their concerns on quality of the product and timeliness of support from the IT department. Cost and budget overruns are high risk factors in all information system implementation projects (Tesch et al, 2007).

1.1.3 The Kenya Civil Aviation Authority

The Kenya Civil Aviation Authority is a State Corporation. It was established through an act of parliament, the civil aviation Act Cap 394 which was amended in 24 October 2002 to take over the functions of the then Directorate of Civil Aviation (DCA) and the Civil Aviation Board (CAB) in the Ministry of Transport. The Authority's main function is to regulate air transport in Kenya. Air transport is the conveyance of passengers and freight using aircraft. It supports other industries like tourism and international trade therefore making it an essential contributor to both domestic and global economic growth. The Kenyan aviation industry is growing at an average rate of ten percent annually (KCAA, 2010). However, the risks associated with flying demands that safety be the key principle for aviation stakeholders. The International Civil Aviation Organization (ICAO) is an agency of the United Nations that oversees safe and orderly development of international civil aviation. It was formed in December 1944 during the Chicago Convention which Kenya is a signatory therefore making it a member or a contracting State of ICAO.

Eighteen annexes have been developed by ICAO which member states comply with. The annexes have Standards and Recommended Practices (SARP) which contain all the aspects of global civil aviation undertakings (Olwenge, 2011). Regulation of the aviation industry in Kenya in accordance with ICAO SARPS is mandated to the Kenya Civil Aviation Authority (KCAA). The authority also provides Air Navigation Services (ANS) within Kenya's Flight Information Region (FIR) and training of aviation personnel through the East African School of Aviation (EASA). All States have complete and exclusive sovereignty over the airspace above their territory (Chicago Convention, 1944). The economic regulation of these airspaces is done using Bilateral Air Service Agreements (BASA). These agreements determine the services that will be offered between two States, the frequencies, the routes and facilities available (Varley, 2002).

KCAA carries out economic regulation of the Kenyan airspace through approval of Air Service Licences (ASL), management of Aircraft leases and Issuance of ad hoc landing and overflight permits. The latter is the most complicated, tedious and repetitive process

of economic regulation of any airspace. It must be done in line with the ICAO SARPs annex 9 which deals with facilitation (ICAO, 2005). According to the Kenyan Aeronautical Information Publication (2010), all Aircraft entering into the Kenyan airspace must have clearance for a scheduled or a non-scheduled operation. Operators or their respective agents have to apply for a permit to overfly or land in Kenya. In applying for the permit, they are be required to provide valid copies of the following documents depending on the category of the flight; Pilot's license, certificate of airworthiness, certificate of insurance, air operator's certificate, certificate of registration, certificate of release to service, dangerous goods transport documents and approval to transport dangerous goods from the appropriate authority.

The increased number of charter flights, tourism, unscheduled cargo and other business related flights has complicated the task of providing ad hoc permits and by extension ensuring a safe and an orderly airspace. Regardless of the repetitive nature of application, processing and utilization of these permits, many ICAO contracting states continue to use manual processes in issuing of these permits. This makes the process extremely tedious and wasteful. In Italy, China and Thailand, application of authorization for non-scheduled service (ad hoc landing and over flight permits) is done at least five days before the operating date (AIP Italia, 2010) and seven days (AIP Thailand, 2010; AIP China, 2010) before operating date. The application with the required documents attached are mailed by post, faxed or emailed to the respective Civil Aviation Authorities. The Authorities' aviation regulation personnel inspect these documents and recommend for granting or denial of a permit. If the permit is granted, it is faxed to the applicant who could be an operator or their agent. Copies are also faxed to all area Airport control centres, control towers, briefing offices, billing offices and cash collection points where applicable.

Air traffic in the Kenyan airspace increased by 10.3% between 2005 and 2010 (KCAA Strategic plan 2010/2011-2014/2015). With increasing air traffic, manual management of ad hoc permits was becoming an intricate task. This situation was worsened by the paperwork it attracted and the many air transport officers that were required to perform

these duties on a daily bases. Proper economic regulation was difficult to sustain and some operators and agents took advantage of the process and were presenting fake permits to air traffic controllers and aeronautical information services officers. KCAA automated this process by developing and implementing the Advanced Air Transport Information System (AATIS). The system was developed and implemented by a team comprised of staff from various KCAA departments.

1.2 Statement of the Problem

The world is quickly changing under the rising influence of information communication technology and globalization which are mutually reinforcing aspects. Information systems in modern organizations have developed immensely and are key to organizing and utilizing information to support administration and management, policy development and decision making therefore improving efficiency, effectiveness and productivity of an organization as a whole (United Nations, 1995). This has led to advanced information system development methodologies which are more flexible and dynamic (Lyttinen & Robbie, 1999).

However, even with increased use of computerized information systems, their development and implementation still remains a very complicated process which is a high risk undertaking with projects failing at a high rate (Tesch et al, 2007). A survey done by Lyttinen and Robbie (1999) found out that American companies spent 59 billion US Dollars in 1995 on runaway information system projects. According to Peterson and Kim (2000), regardless of methodological advances and years of experience in development and implementation of information systems, 90% of these projects fail to realize their goals with 31% of them being canceled before completion. When comparing information systems development between developed and developing countries, in spite of the latter having cases of successful information systems projects, there is frequent literature of information systems that failed to meet their expectations (Heeks, 2002). In Kenya, implementation of information systems in State Corporations does not usually deliver satisfactory results (Magutu et al, 2010) with systems failing to meet their expectations.

The challenges in development and implementation of information systems often differ between acquisition methods, private companies and Government institutions and even duration of the projects. A study done by Heeks (2002) established that gaps between design and actual usage of information systems are a major reason for failure in implementing information systems in developing Countries. These gaps are inherent in the designs of technologies to be used, processes, staffing and skills, resources and management. A review of information technology project risk factors done by Tesch et al (2007) categorized time, cost, performance and quality as the major factors. Geethalakshmi (2009) examined the impact of non-technical components on success and failure of in-house software development. The study established that project management, top management support, requirements management and user support mostly affected software development but the impact varied between the type of information system, duration and development methodology. Mutai (2010) studied the challenges facing Kenyan commercial banks in implementation of decision support systems. The major challenges identified were lack of understanding of the benefits of the system, poor planning and organizational culture. Magutu et al (2010) did a critical evaluation of the challenges of information systems implementation in Kenyan Parastatals. The study established the major challenges as; process and structure, procurement and communication, information systems design and people management, corruption, technical and systems tuning. An empirical review and evaluation of the causes of project failure done by Kariuki (2008) ranked poor communication, lack of stakeholders involvement and lack of resources as the major contributors to project failure.

From these studies, knowledge of challenges facing development and implementation of information systems and ways of addressing them in various contexts exists. Nevertheless, it is clear that organizations have been unable to resolve information system implementation challenges and learn from past failures. According to Tesch et al (2007), information system development challenges are constantly evolving and new

challenges need to be established continuously in deferent contexts as well as new strategies of resolving them.

In an industry fast growing, complex and highly regulated internationally like air transport, the process of implementing an information system within a State Corporation becomes more difficulty to undertake. No other studies have been carried out which particularly highlight the challenges of implementing information systems in aviation regulation. Nonetheless, KCAA successfully automated the process of authorization of landing and overflying in the Kenyan airspace. An in-depth insight into the challenges encountered would provide invaluable practical knowledge in addressing information system development and implementation challenges not only within aviation regulation, but also in other organizations. This study sought to answer the following research questions; What are the challenges of developing information systems in Aviation regulation? What are the challenges of implementing information systems in Aviation regulation?

1.3 Research Objectives

The objectives of this study were to:-

a) Establish the challenges of developing information systems in aviation regulation in Kenya and

b) Establish the challenges of implementing information systems in aviation regulation in Kenya

1.4 Value of the Study

Understanding the challenges experienced in automation of adhoc landing and overflying permits in the Kenyan airspace will bring in-depth knowledge of information system development and implementation challenges in many Kenyan State Corporations and other Organizations at large. Top managers in Organizations and ICT consultants will be able to identify challenges in good time and resolve them therefore increasing the rate of

success in information systems development and implementation. Information systems project managers will also get vital information on ways of addressing the challenges of information systems.

The management of KCAA will be able to use the findings of the study to work on the current problems with the AATIS to make it serve the aviation industry better. The study will also be useful in dealing with computerized information system challenges inherent in other departments of the Authority namely; flight operations, airworthiness, aviation personnel licencing and aeronautical information services flight planning section. The Civil Aviation Safety and Security Oversight Agency (CASSOA), the body mandated by ICAO to harmonize aviation safety and security in the East African region will immensely benefit from the findings of these study. This is because the other East African Countries issue adhoc clearances and permits using manual procedures and implementing their own systems or even adopting the AATIS will be a magnitude step towards improving security and safety oversight in the region. In addition, CASSOA is currently experiencing major challenges within its major states in implementing harmonized information systems. The findings of this research will be of great importance towards resolving these challenges and anticipating them in future information system projects.

There are many other ICAO contracting States whom are issuing adhoc landing and overflight permits manually. In Italy, China and Thailand, application of authorization for an adhoc permit is done at least five days before the operating date (AIP Italia, 2010) and seven days (AIP Thailand, 2010; AIP China, 2010) before operating date. This study will be useful for ICAO or these states towards automating this important area of aviation economic regulation.

Lastly, this study will add to the information systems development and implementation's pool of knowledge and the findings will provide a platform for future studies in the same field and provide other scholars with a basis of further research.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter details a review of the related literature of the subject under study by various researchers, scholars, analysts and authors. The review will discuss components of information systems, ways of developing and implementing them, challenges of development and implementation of information systems and propose ways of addressing these challenges. The literature will be drawn from several sources that are closely related to the purpose and objectives of the study.

2.2 Development and implementation of Information Systems

Information systems can be defined as the interaction between people, processes and technology to support business requirements (Shelly et al, 2008). An information system incorporates both the technology an organization uses as well as the way the organization's people interact with the technology to carry out day to day transactions and decision making. According to Shelly et al (2008), an information system comprises of hardware, software, data, people and processes. Hardware consists of everything that is in the physical layer of the information system. Software refers to the computer programs that control the hardware to generate the requisite output. Software is grouped into application software and systems software. Data is the raw material that is entered into an information system to generate useful information. Processes are the tasks and business tasks that are performed by different people in the information system to produce required output. In an information system, people interact with the system to enter data and generate important information for decision making.

Kroenke (2010) defined information systems development as the process of creating and maintaining information systems and it encompasses all the five components of an information system. Developing an information system requires both technical and non-

technical skills. This makes the process of developing an information system difficulty and risky and therefore established development methodologies should be followed. A survey of system development process models done by the Centre for Technology in Government University at Albany (1998) established that the main objective for implementing information systems is to effectively and efficiently support business processes objectives. System development process models have to be employed to ensure a quality and cost-effective system is developed that will address an organization's business requirements. The survey further outlined the following typical tasks that are normally executed when developing and implementing a computerized information system; system conceptualization, system requirements and benefits analysis, project adoption and project scoping, system design, specification of software requirements, architectural design, detailed design, unit development, integration and testing, installation at site and user acceptance testing, training and documentation, implementation and maintenance.

Although all information system development projects engage in some combination of the above tasks, differences emerge from timing of the tasks, feedback loops and control methods (Kendall and Kendall, 2006). According to the survey done by the Centre for Technology in Government University at Albany (1998), most of the system development methodologies in use today have evolved from three primary approaches; adhoc development, waterfall model and iterative and incremental processes. In adhoc development, the process is rather haphazard and chaotic relying on skills and experience of individual staff members to accomplish the task. Requirements, schedules and budgets are difficulty to establish because the whole process is inconsistent and undefined. Kroenke (2010) cited that with modern complex requirements for information systems, using adhoc processes will likely lead to failure of the project.

The System development life cycle according to Kendall and Kendall (2006) and Kroenke (2010) was the earliest structured method of system development. By the 1970s, most system analysts and project managers established the main tasks that are

accomplished during the development of an information system. According to Kroenke (2010), different organizations and authors differ on the exact number tasks in the system development life cycle. The five major steps are; system definition, requirements analysis, component design, implementation and system maintenance. During system definition, the system's goals are defined, its scope and feasibility. The project planning is done at this stage which includes forming the project team. The second phase of requirements analysis is the most important in the life cycle. Existing systems are evaluated and the new features and functionalities of the new systems determined. Security of the system and data models are also analysed at this stage (O'Brien, 2007). The requirements must be approved at this stage before the projects moves to the design stage.

At the design stage, the five components of an information system are designed. These include the hardware, software, database, procedures and responsibilities of various users. After the design the system is build, tested and converted to production environment. Kroenke (2010) and Nyaga (2006) listed four main ways of system conversion namely; pilot, phased, parallel and plunge. In the pilot conversion method, the entire system is installed in a limited section of the Organization. It is also known as modular or franchising strategy (Nyaga, 2006). In phased installation, the system is installed per modules. It is also known as process oriented. As the name suggests, with parallel installation the new system runs in parallel with the old system until a time where by the new system is fully tested and operational. The plunge installation also known as big bang is the most ambitious and risky. The old system is shut down and the new system takes over immediately. The last stage of the life cycle model is system maintenance where by the system is enhanced and failures fixed by use of patches, service packs or new releases.

The survey of system development process models done by the Centre for Technology in Government University at Albany (1998) established that the software development life cycle which works like a water fall has major shortcomings because of its inability to

move back to the previous stages. Kroenke (2010) cited that there is always need to crawl back the waterfall to a prior stage because system development is seldom a smooth process. This has led to other modern system development methodologies like prototyping, rapid application development, the spiral model and agile development. According to Kendall and Kendall (2006), these modern methodologies lead to quick and dynamic results in systems development. They are loosely based on the stages of the traditional waterfall model but allow for feedback, control and ease of movement between the stages unlike the software development life cycle.

2.3 Challenges in development of Information Systems

Public and Private organizations are experiencing an upsurge in the information systems they use in their day to day activities. With the information age, it has become almost impossible for organizations to operate without the use of one or more information systems (Beaumaster, 2009). Despite the many advantages that an organization can derive from the use of information systems, their development is a very complicated process and dependant on a multitude of important and interrelated factors that affect their success.

A study by Procaccino et al (2000) on the factors for early predictions for software failure or success established user involvement as one of the major contributors to success or failure of development and implementation of an information system. According to the study, users involvement lead to a strong buy in of the system and contributes to a perceived usefulness of the project. Therefore, lack of involvement of users in the development of the system will lead to user resistance and unmet expectations. Mutai (2010) attributed lack of user support as a big contributor to failure of implementation of decision support Systems in Kenyan banks. According to Mutai (2010), if users are not involved, the risk of gathering poor requirements is very high.

In a study on implementation of Information Systems in Kenyan State Corporations, Borura (2009) emphasized on the importance of user involvement towards success of

Information Systems Implementation. The ideas and reasoning of the users will be reflected in the System therefore increasing their sense of ownership (Obrien, 2007). The interactions between the Information System technical implementers and the users brings out a deeper and more practical understanding of what the System should do as well as acting as a training platform for the users. Procaccino et al (2000) gave guidelines the ideal users who would have a great impact on success when involved in a system development project. They should be highly motivated and willing to be involved throughout the project to the end, they should have realistic expectations, they should be influential in their respective sections and people who are not likely to leave the organization before the project is complete.

According to Nah et al, (2001), lack of top management support in an information system project is recipe for disaster. Top management makes an organization's most critical decisions. Implementing and information System requires resources and time as well as bringing change to the Organization. Top management needs to declare publicly the importance of the project and make it a top priority to the organization. Roberts and Barar (1992) emphasized on the importance of top management support particularly in arbitration of conflicts arising during the development process, overseeing the project to make sure that it stays on track.

A study on empirical review and evaluation of causes of project failure carried out by Kariuki (2008) ranked project planning fourth in the factors causing project failures. The study found out that most project lack detailed plans hence their failure. This may be attributed to the fact that some project managers views planning as a waste of time that could already be used in executing the project.

According to Geethalashmi and Shanmugam (2008), when planning for an information system, a correct balance should be achieved between managing the technical and non-technical issues. Managing non-technical issues is more complicated than managing

technical issues. These include budget, schedule and people who come with different personalities, weaknesses and dedication levels. Defining the project formally in terms of key milestones and critical paths is of the essence for its success. Good project management is also key to mitigating project risks and being able to identify them early in advance, plan and respond appropriately (Tesch et al, 2007). A project charter should be signed which is a basic agreement between the system implementers and the users of the system. The charter should contain the objectives, deliverables and goals that the system should accomplish. Responsibilities between the project team members should be clearly outlined the reporting channels. The project team should also establish the metrics of the project which will enable measuring of progress and well as being able to judge their performance. The project team should be lead by a project champion who should have high authority in the Organization. The entire implementation team should also identify as many project risks as possible and ensure that they are able to handle them when the need arises.

Failure to manage requirements well contribute highly to the failure of implementation of Information Systems (Glass, 1998). A clear perception of the problem to be solved and how it will be resolved eliminates scope creep, unrealistic user and stakeholder expectations and excessive project cost (Procaccino et al, 2000). Poor management of requirements makes systems development even more difficulty because it aims at a moving target (Kroenke, 2010). Quality of software can be defined to the degree to which a System, its components and processes meets the specified requirements (Misra and Fernandez-Sanz, 2011). Gathering of clear and succinct requirements can be a challenge to developers as well as the understanding the requirements between the users and the developers. Users no matter how thoroughly the requirements were collected will always want to change them and bring new additions during and after implementation.

According to Kroenke (2010), evolving or unfrozen requirements leaves the project team aiming at a moving target. When requirements are changing, it becomes difficult to control the scope of the project. When collecting system requirements, all the

stakeholders' views should be discussed exhaustively and documented well (Tesch et al, 2007). All the stakeholders should also understand the scope of the project and the schedule. After all the requirements of the system have being consolidated with feedback, milestones and schedules, the key stakeholders must approve and sign them off for ownership and to freeze them. Setting up stakeholder review after each milestone is also important to ensure that the expectations are well managed as the development of the system progresses

Kiprono (2006) cited that employees in organization experience a variety of technological challenges posed by the rapidly changing information technology environment. Despite the need for information technology workers increasing, the identification for required skills for a variety of positions is still not yet clear. This was also echoed by Kendall and Kendall (2006) who stressed the increasing demand for information systems workers. According to Alters (1980), gross incompetence by implementers of the system will be inclined to crystallize into a poor product. In an analogy, he says that a general medical practitioner might not perform particularly well if he is called on to perform brain surgery.

Systems implementation is not a day to day activity hence it is a requirement that it should be done by a specialist or not at all because of the investment of time and resource involved. Therefore, regardless of how clear a system's requirements are and how well the process is managed, technical expertise and skills will always be key to it quality and achievement of its objectives. High technical expertise and experience is required. This is cited by Maguire (2002) and Mutai (2010) as one of the key challenges of Information Systems implementation. A study by Tesch et al (2007) established that one of the major information technology risks is lack of the required knowledge and skills and it will lead to poor quality work and outsourcing of consultants which yield to cost overruns.

For organizations to succeed in development and implementation of information systems, they should invest in certified and experience information systems and technology staff. Shelly et al (2008) cited that information system professionals should align themselves strategically with the changes in the information systems environment to remain productive in the changing business environment. This should be through formal training, certification and benchmarking with fellow professionals. Tesch et al (2007) cited that organizations who intend to continually implement information systems should constantly do a training need analysis to identify skills gaps within its personnel. For one time projects, temporary resources can be used and it is always advisable not to commit to commence on the project without the required skills set.

Communication barrier between end user and developer usually results in the "Tower of Babel" scenarios during system development and also once the system is ready for implementation. Kariuki (2008) ranked poor communication as the top cause of failure of projects of any type. When implementing a system where the communication channels are not clear, the system usually ends up being a disappointment. This further compounded if the requirements are collected from a large number of users. It makes it difficult for the developer to capture all those requirements into a single system in the limited timeframe usually provided by organization for the project to be completed. Obrien (1993) and Awad (1997) both give a pictorial explanation of what actually goes on in the system procedure when there is communication breakdown in to six sentences as follows; first the requirements as proposed by the sponsor, as specified in the project request, as designed by the senior analyst, as produced by the programmer, as installed at the user's site and finally what the user actually wanted. These sentences depict a serious breakdown in communication and understanding what the user actually wants.

Tesch et al (2007) outlined budgeting and schedule overruns as a major risk in implementation of information technology projects. This was further echoed by a different study carried out by Shahzad and Safvi (2008). The risks associated with budgeting of projects include; under funding of development, deviation from budget and

underfunding of maintenance. Tight deadlines and underestimation of development timelines compromise the quality of the work done and may lead to failure of information systems projects.

To mitigate cost overruns, Shahzad and Safvi (2008) suggested the use of algorithmic and non-algorithmic models. Tesch et al (2007) recommended that projects cost and budgets be estimated in phases if all resources cannot be availed at the beginning. For each particular phase, funding should be assured upfront and the initial budget should accommodate minimal deviations which should be understood by the stakeholders and sponsors. If need for additional funding arises, it should be well explained to the sponsors and the other stakeholders.

Other studies have established more information system development challenges. A study done by Tesch et al (2007) established challenges like introduction of new technologies and lack of scientific development methods. Within Kenyan State Corporations, Magutu at el (2010) identified the following unique challenges; corruption, bureaucracies in Government projects, inadequate system testing, slow procurement processes, scope creep, poor information systems interface, inability to retain technical staff and insufficient software evaluation.

2.4 Challenges in Implementation of Information Systems

Most of the challenges experienced in the development phase of information systems are also inherent in the implementation phase. These challenges include support from users, poor communication, poor project management methodologies and lack of resources. However, some of these challenges have different bearings during the implementation stage. According to Procaccino et al (2000), the characteristics of users who would have a great impact on success when involved in the development may be different from the users who will be involved in the implementation. Influence among other users and ability to drive change are more desirable qualities in the implementation stage of the system.

Roberts and Barar (1992) emphasized on the importance of top management support particularly in arbitration of conflicts arising during the implementation process. They will also be called upon when making critical decisions like stopping the usage of the old system and adopting the new system. Top managers make major approvals in organizational processes and insisting on using the system to do approvals ensures that the originators of the processes make use of the system.

In today's business atmosphere, change has become an everyday element of organizational operations and an employee who resists change can comprise the development and operations of an organization (Ahmed et al, 2006). A study by Gupta (2000) illustrated that the impediment faced by most organizations in implementation of information systems was the resistance by staff to change. He further expanded on this by explaining that either the resistance was due to employees refusing to learn new techniques or it was due to the information technology department being reluctant to change due to its attachment on a particular product. Ahmed et al (2006) further described resistance to change as "employee behavior which is intended to protect an individual from the effects of real or imagined change". An employee who is resisting change can interrupt, confront or reverse established assumptions, discourses and power relations. Employees who resist change lack a strong corporate identity that is conducive to change. This is further amplified by a comfort zone which many employees are accustomed to in their daily to daily operations therefore inducing lack of willingness to accept new technology. Users can also resist change just because of fear of doing new things (O'Brien, 2007).

Setting up an Information System without the right infrastructure in a recipe for failure. Magutu et al (2010) outlined poor infrastructure as one of the challenges of Information Systems implementation in Stare Corporations. Infrastructure such as data centers, networks and even personal computers are critical towards successful implementation of software. According to Mutai (2010), technological assessment needs to be carried before implementing information systems to determine the whether the hardware and software

resource that is in place can support the new system. The network resources should also be analysed to ascertain its sufficiency to connect all parties involved. New hardware and supporting software should be acquired in good time so that they do not affect the progress of the implementation of the information system.

Heeks (2002) studied the causes for full, partial or sustainability failure in implementation of information systems. The study established that this is caused by design and actuality gaps. These gaps are inherent in software designed and developed in western countries and being implemented in developing countries. According to Heeks (2002), the designer may as well be automating a fiction. These gaps are caused by rationality in operations in developed countries and the "soft political" actuality in developing countries. The gaps are inform of technology, resources, processes and objectives. Use of local improvisations will resolve the gaps between the design and actual usage.

A number of studies have pointed out more challenges in implementation of information systems. Mutai (2010) identified more challenges like regulatory frameworks, Organizational politics, poor attitude towards quality improvement, comfort zones, unsatisfactory end user training and quick technology advancements. Magutu at el (2010) highlighted the following unique challenges in Kenyan State Corporations; difficulty in data conversion, high cost of licences, low IT literacy levels, customizations required and security issues. Tesch et al (2007) established challenges like introduction of new technologies, conflict between user departments, poor documentation and unethical behaviour.

2.5 Literature Review Summary and Conceptual Framework

Information system development and implementation is a complex process with many challenges. With increased use of information systems, these challenges are evolving,

becoming more complex and vary between the development and implementation context. From the literature review, the process of building an information system can be divided into two major parts; development and implementation. Development entails system conceptualization, system requirements and benefits analysis, project adoption and project scoping, system design, specification of software requirements, architectural design, detailed design, unit development, integration and testing. Implementation of the already built or acquired solution entails installation at site, customization, data migration and conversion, user acceptance testing, end user and technical training, documentation, system conversion (system change over) to live environment and maintenance.

Common challenges may be experienced in each segment but some challenges are particular to each part. The major challenges in development and implementation of information systems are; lack of user support and participation, lack of support from top management, poor project management, poor requirements management, lack of technical expertise and skills, poor information technology infrastructure, poor change management and communication barriers. This study seeks to establish the challenges and ways of addressing them in the aviation regulation sector in an in-house development environment.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Research Design

The problem posed in this research was studied using a case study method. A case study emphasizes depth rather than breadth, and the study entailed a descriptive research design (Kothari, 1990). The research generated both quantitative and qualitative data in order to explore experiences, behaviour and attitudes (Dawson, 2002). Aviation regulators in many States use manual systems in their operations because of challenges in development and implementation of computer based information systems. An in depth study of the challenges faced during development and implementation of AATIS in KCAA was important in improving the levels of automation in Aviation regulation.

3.2 Population

The study targeted the development and implementation team of 9 members involved in the development and implementation of the KCAA Advanced Air Transport Information Systems (AATIS), the project's steering committee of 6 members and the key users who participated in requirements collection, user acceptance testing, training and deployment. A total of 17 users were involved during collection of requirements, user acceptance testing, training and deployment of the system. Table 1 illustrates the different members of the targeted population.

Table 1 : The target population

	Target group	**No. of staff**
1.	Project steering committee	6
2.	Development team	9
3.	Users involved in requirements collection, acceptance testing and deployment	17
	Total	**32**

3.3 Data collection

The study used primary data. Due to the small size of the population, a census study was be carried out. The data was collected through the use of interviewer and self administered questionnaires as annexed in Appendix I. Due to the busy schedules and availability of the members of the project steering committee, the questionnaire was administered to them by the researcher. The 'drop and pick' method was used for the rest of the population. This method afforded the respondents, whom majority work in shifts, the time to answer the questions at their own pace as well as give them time to think through the questions and recollect.

The questionnaire was divided into four parts. The first section comprised of questions about the profiles of the respondents. The second section collected data on the challenges of development of information systems while the third section collected data on the challenges of implementation of information systems. The fourth section of the questionnaire consisted of questions which lead to understanding the general automation challenges in aviation regulation in Kenya.

3.4 Data Analysis

Descriptive statistics were used to analyse the data on the demographic of the respondents, the challenges of development and implementation of information systems and section four of the questionnaire. This was achieved by use of the mean, standard deviation and frequency distribution. The process of analyzing data was aided by the use of an analytical package (Statistical Package for the Social Sciences).

Content analysis was used to analyse the qualitative data in the questionnaire. Coopers and Schindler (2003) describes content analysis as a technique for objective, systematic and qualitative description of the manifest content of a communication. It guarded against selective perception of the content and provided for rigorous application for of validity and reliability criteria. The entire analysis process established themes, patterns, trends

and relationships in order to come up with useful information that crystallized to achieving the objectives of this study.

CHAPTER FOUR

DATA ANALYSIS, RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents analysis, discussion and the research findings. The aim of the study was to identify challenges that hampered the development and implementation of AATIS in automation of adhoc landing and overflight permits in the Kenyan Airspace. Section one contained general information about the demographics of the respondents. Section two and three had structured and unstructured questions on the challenges of developing and implementing the AATIS. Section four focused on the automation levels in Kenyan aviation regulation and ways of improving these levels. Out of the 32 respondents that the research targeted, 29 responded to the questionnaire amounting to a response rate of 90.62% which is a significant rate of response.

4.2 Respondents' Demographics

The study sought to determine the age group of the respondents. The results as presented in Table 2 indicate that 41.1% of the respondents were aged between 36 and 40 years. This shows that majority of the respondents were flexible to change.

Table 2: Distribution of respondents by age

Age		
Years	**Frequency**	**Percent**
<30 years	3	10.3
30-35	2	6.9
36-40	12	41.4
41-45	5	17.2
46-50	2	6.9
51-55	3	10.3
>55 years	2	6.9
Total	**29**	**100.0**

Source: Research data, 2012

The respondents who participated in the study were requested to specify the duration of service in KCAA including the defunct DCA. The results in table 3 show that 68.9% of the employees who participated in the survey have worked in KCAA for more than ten years.

This tends to point out that the majority of the employees who participated in the development and implementation of the AATIS have a lengthy experience in aviation regulation. Compared to the age of the respondents in Table 2, this implies that most of the respondents started working in DCA/KCAA and therefore have possibly established a comfort zone, a major challenge in implementation of information systems.

Table 3: Distribution of respondents by the number of years worked for KCAA/DCA

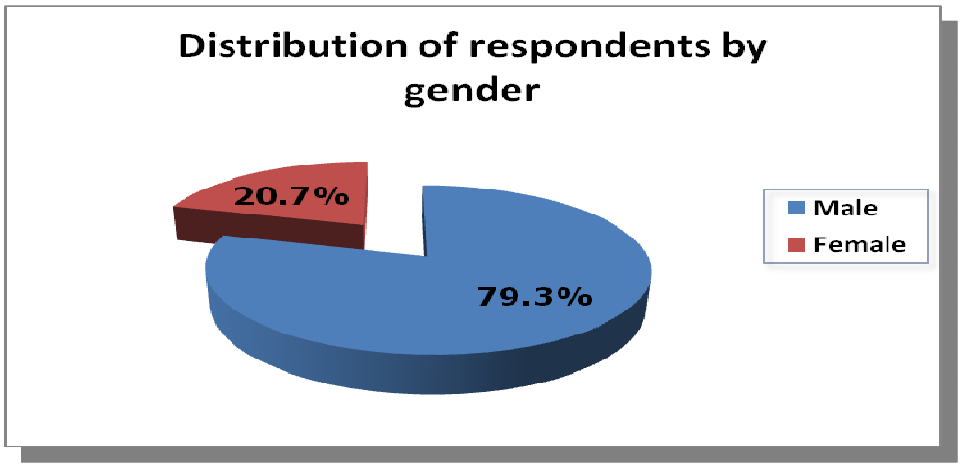
Number of years worked for KCAA/DCA		
Years	**Frequency**	**Percent**
<5 years	6	20.7
5-10	3	10.3
11-15	6	20.7
16-20	9	31.0
>20 years	5	17.2
Total	**29**	**100.0**

Source: Research data, 2012

Figure 1 illustrates the distribution of respondents by gender. 79.3% are Male while 20.7% are Female. This is a depiction of male dominance in the aviation regulation industry. This is in agreement with a study done by Olwenge (2011) on the factors affecting the provision of air traffic services in the Kenyan airspace. Figure 2 illustrates the education levels of the participants. 75.9% of the respondents had a degree while 24.9% had a professional certificate. These results suggest that most of the employees had acquired good education levels and skills in their respective areas of operation. According to Heeks (2002), high formal educations levels is critical to successful implementation of information systems in developing Countries.

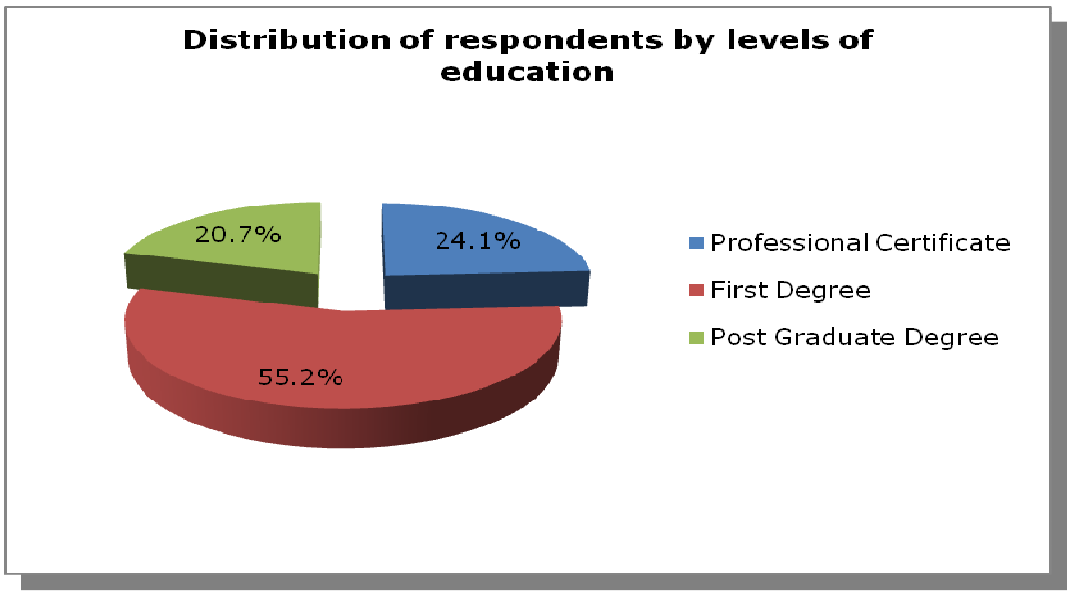
Figure 3 illustrates the distribution of the respondents who were involved in the development of the System. 17.2% of the 29 respondents were in the positions of a director or manager. This implies that there was involvement of management in the development and implementation of the system.

Figure 1 : Distribution of respondents by Gender



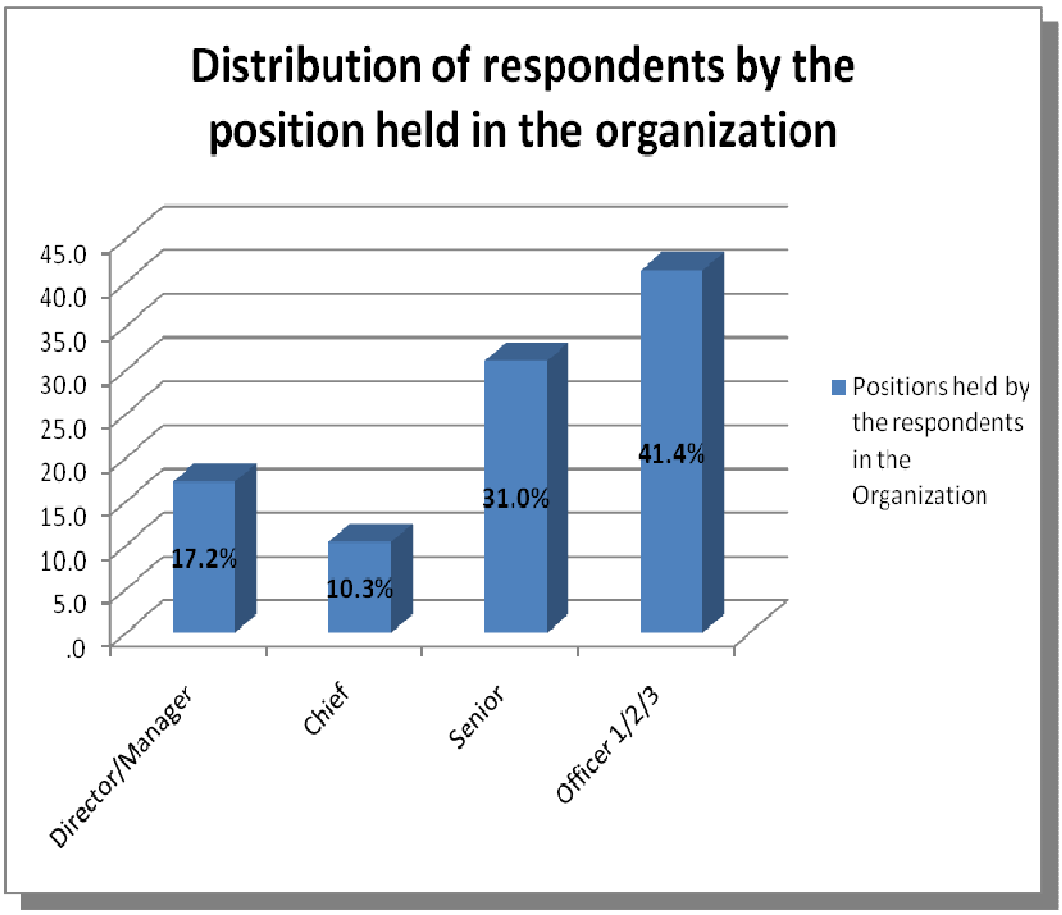
Source: Research data, 2012

Figure 2: Education levels of respondents



Source: Research data, 2012

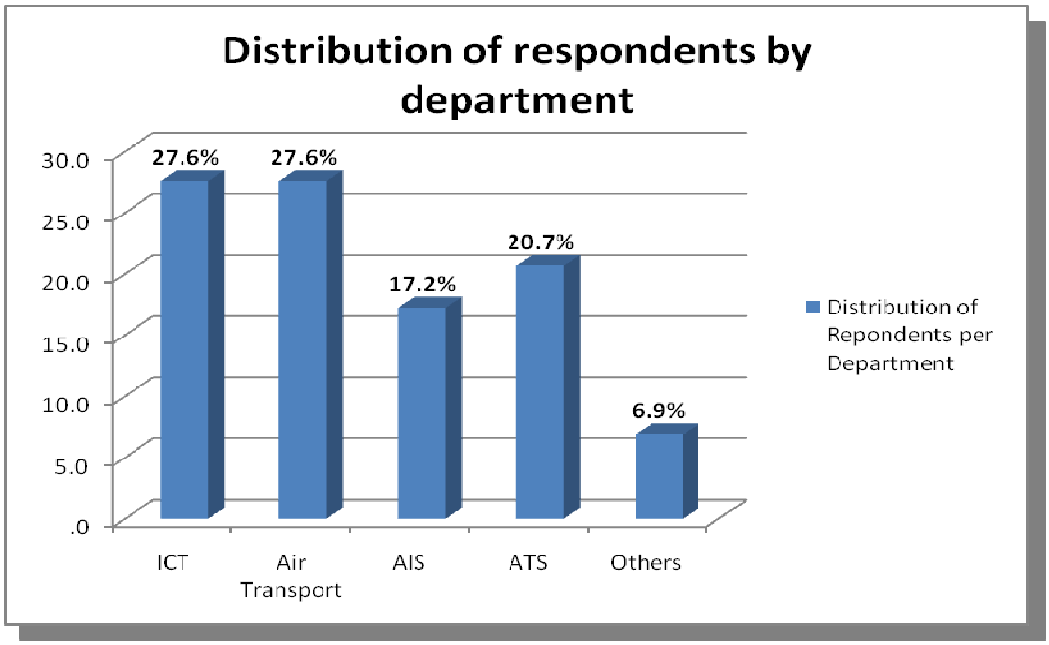
Figure 3 : Distribution of Positions held by the Respondents



Source: Research data, 2012

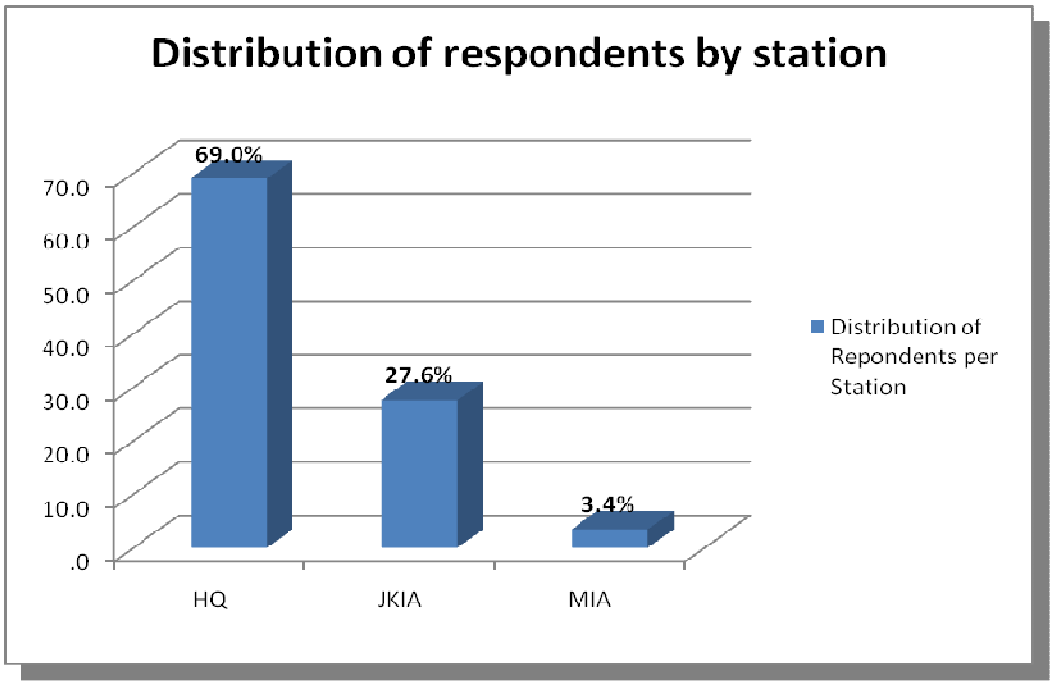
Over 60% of the respondents were from the KCAA headquarters. There were also respondents from JKIA and MIA as depicted in Figure 4. Given that most of the processes in the AATIS originate from the KCAA Headquarters then the data is used in the Stations, this was a representative distribution. Department wise, the users were well involved with over 72% of the respondents being from the user departments. The 6.9% of the respondents who are in the category 'others' were involved in user requirements collection and training and they are from the Finance and Accounts department. This is illustrated in figure 4.

Figure 4 : Distribution of respondents by department



Source: Research data, 2012

Figure 5 : Distribution of respondents by station



Source: Research data, 2012

4.3 Challenges of the development of AATIS

In analyzing challenges that faced the development of AATIS, a 5 point likert scale was used as the basis for measuring to what extent a particular challenge was encountered. 1 represented no extent, 2 represented little extent, 3 represented moderate extent, 4 represented a great extend and a very great extent was represented by 5. The various responses were averaged which resulted in a mean score. A standard deviation was computed to indicate how responses varied from one respondent to the other. A standard deviation of less than 1 indicates consensus among the respondents and a standard deviation of greater than one indicate considerable dispersion in responses obtained.

Table 4 : Challenges encountered during the development of the AATIS

Challenge	**N**	**Min.**	**Max.**	**Mean**	**Std. Dev.**
Bureaucracies in Government projects	29	4.00	5.00	4.6207	0.49
Organizational politics	29	3.00	5.00	4.5862	0.57
Slow procurement processes	29	3.00	5.00	4.5517	0.63
Schedule overruns	29	3.00	5.00	4.0345	0.73
Poor change management	29	2.00	5.00	3.6552	0.97
Poor requirements management	29	2.00	5.00	3.5862	0.73
Inability to retain technical staff	29	2.00	5.00	3.5172	0.73
Poor attitude towards quality improvement	29	2.00	5.00	3.3448	0.90
Lack of commitment from top management	29	1.00	5.00	3.2414	1.02
Lack of technical expertise in developers	29	1.00	5.00	2.9655	1.18
Quick technology advancements	29	1.00	4.00	2.5862	0.82
User comfort zones	29	1.00	4.00	2.5517	0.87
Communication barrier	29	1.00	4.00	2.4483	0.91
Poor project management	29	1.00	4.00	2.4483	0.89
Lack of support from top management	29	1.00	3.00	2.4138	0.63
Lack of user participation	29	1.00	4.00	1.8276	0.93
Technical Staff Comfort zones	29	1.00	2.00	1.6897	0.47
Corruption	29	1.00	4.00	1.6207	0.94
Insufficient software evaluation	29	1.00	2.00	1.2759	0.45
High cost of licences	29	1.00	2.00	1.1724	0.38
Budget overruns	29	1.00	2.00	1.1724	0.38
Inadequate system testing	29	1.00	2.00	1.1034	0.31

Source : Research data, 2012

From the above data, the following deductions can be made. Bureaucracies in Government projects, organizational politics and slow procurement process are the top three challenges that were encountered to the greatest extent during the development of the AATIS. The standard deviations were all significantly below 1 signaling a high degree of consensus among the respondents. In addition, the three factors had means above 4.5 therefore putting them under challenges that were very highly faced.

Other challenges faced to a great extent are schedule overruns, poor change management, poor requirements management and inability to retain technical staff. The challenges had mean values of more than 3.5 and the standard deviations were lower than 1. Lack of commitment from top management and lack of technical skills and expertise from developers were moderately faced with means of 3.2 and 2.97 respectively. However, their standard deviations were above 1 with minimum values of 1 and maximum values of 5 which means that many respondents did not quite agree on the severity of these particular challenges.

The challenges that were not encountered in the development of the system are inadequate testing, budget overruns, high cost of licences and insufficient software evaluation. This is because these challenges all had means of less than 1.5. This is further echoed through their standard deviations of less than 0.5. The high levels of consensus means that almost all respondents agreed to not encountering these challenges at all. Given that the AATIS was developed in-house by the staff of KCAA, the issue of high cost of licences and insufficient software evaluation can be completely ruled out. This is because these two processes are normally applicable for proprietary software.

Many respondents had highly divided opinions on the extent of the following challenges; lack of commitment from top management, lack of expertise in developers and poor change management. The standard deviations for these challenges were all above 0.95.

4.5 Challenges faced in implementation of AATIS

Some of the challenges that are faced in the development phase of a system are also encountered during the implementation phase. There are also many other challenges that are particular to the implementation phase of an information system. During the implementation phase of the AATIS, the challenges faced are listed in table 5.

Table 5 : Challenges faced in implementation of AATIS

Implementation Challenges	**N**	**Min.**	**Max.**	**Mean**	**Std. Dev.**
Poor IT infrastructure - Internet and WAN Links	29	4.00	5.00	4.7586	0.44
Poor IT infrastructure - Computers	29	3.00	5.00	4.6897	0.61
Bureaucracies in Government projects	29	3.00	5.00	4.4138	0.63
Conflict between user departments	29	3.00	5.00	4.4138	0.68
Slow procurement processes	29	1.00	5.00	4.3793	0.94
Organizational politics	29	3.00	5.00	4.3448	0.77
Regulatory frameworks	29	3.00	5.00	4.2414	0.74
Schedule overruns	29	2.00	5.00	4.1379	0.88
Poor IT infrastructure - Local Networks	29	2.00	5.00	3.7586	1.02
Design and usage gaps in processes	29	1.00	5.00	3.6207	0.82
Poor attitude towards quality improvement	29	1.00	5.00	3.4483	0.95
Poor change management	29	2.00	9.00	3.2069	1.32
Lack of commitment from top management	29	1.00	5.00	3.0345	1.05
User comfort zones	29	1.00	4.00	2.6207	0.98
Lack of IT Skills from users	29	1.00	5.00	2.6207	1.21
Poor project management	29	1.00	4.00	2.4138	0.68
Information security issues	29	1.00	4.00	2.3448	0.86
Communication barrier	29	1.00	4.00	2.2759	0.75
Design and usage gaps in staffing	29	1.00	5.00	2.1724	0.97
Quick technology advancements	29	1.00	4.00	2.1034	1.05
Corruption	28	1.00	3.00	2.0714	0.90
Lack of support from top management	29	1.00	4.00	2.0000	0.76
Technical Staff Comfort zones	29	1.00	3.00	1.8621	0.58
Lack of technical expertise and skills	29	1.00	4.00	1.6897	0.76
Inadequate system testing	29	1.00	2.00	1.4483	0.51
Design and usage gaps in technology	29	1.00	5.00	1.4483	0.95
High cost of licences	29	1.00	2.00	1.1724	0.38
Lack of resources	29	1.00	2.00	1.1724	0.38
Difficulty in data conversion	29	1.00	2.00	1.1034	0.31
Budget overruns	29	1.00	2.00	1.0690	0.26

Source : Research data, 2012

In analyzing challenges that faced the implementation of AATIS, a 5 point likert scale was used as the basis for measuring to what extent a particular challenge was encountered. 1 represented no extent, 2 represented little extent, 3 represented moderate extent, 4 represented a great extend and a very great extend was represented by 5. The mean and standard deviations were used to analyse the data.

Poor IT infrastructure in terms of WAN links and internet availability was the greatest challenge encountered while implementing the AATIS. KCAA has stations spread across the country and good connectivity is critical to implementing an application that will be used by all the stations. Consistent and reliable internet services were also very important to the AATIS because external users like airline operators, aircraft owners and agents rely on the services to make requests for adhoc permits. Poor IT infrastructure in terms of computers was the second highest ranked challenge with a mean of 4.7 and a standard deviation of 0.6. Most of the computers that users were using to access the system were aged, slow and in some other stations totally unusable.

Other challenges encountered to a great extent were bureaucracies in Government projects, conflicts between user departments, slow procurement processes, organizational politics, regulatory frameworks and schedule overruns. The challenges has mean values above 4.1 and standard deviations below 1. Some users resisted use of the AATIS because the Kenyan AIP only covered manual processing of clearance permits. The implementation team had to wait until the AIP was amended and a Notice to Air Men (NOTAM) issued so that they can accept application of online permits. The Civil aviation act CAP 394 had clauses which some users and operators quoted to resist usage of the System. This became a difficult barrier to operationalization of the system resulting to suspension of some modules. Conflicts between departments had a mean value of 4.4 and a standard deviation of 0.68. This was mainly between ATC, AIS and Air transport departments.

Budget overruns, difficult in data conversion, lack of resources, high cost of licences, design and usage gaps in technology and inadequate system testing had mean values below 1.5. The standard deviations of less than one means that the respondents concurred on this challenges not being encountered at all during the implementation of the AATIS. Respondents had highly divided views on the extent of challenges like quick technology advancements, lack of IT skills from users, lack of commitment from top management, poor change management and poor IT local area networks.

Other challenges raised by respondents from the air transport and ICT departments were training of external users and poor infrastructure of some external users. The external users of the AATIS are comprised of operators and agents within and outside the Country. Agents and operators within the main Kenyan aerodromes had training sessions held for them. However, this was difficult to do for their counterparts outside the Country. User manuals were emailed to the main applicants and others would be trained via phone. This process was very cumbersome for the implementation team and the air transport department. Some Countries especially within Africa have very poor internet penetration and users would have difficulties using the System. Some applicants also had extremely huge documents that could not be transmitted via the system. The implementation team in this case would intervene and convert their documents to low size portable document formats.

4.4 How Challenges were addressed

The development and implementation of the AATIS was considered very successful by all the respondents. This was mainly because the challenges that were encountered were able to be resolved. Most of the solutions that were agreed on would resolve most of the challenges right from the development to the implementation of the System. The study found out that before the decision to develop the System in house was reached, an attempt had been made to outsource the development and implementation of the System.

Slow procurement processes, lack of IT infrastructure particularly servers, WAN links and reliable internet services, bureaucracies in Government projects, poor requirements management and organizational politics largely contributed to the failure of the outsourcing attempt. The management of KCAA made the automation of ad hoc permits a major target between the Director General and the Board of Directors. This brought in commitment and dedication right from the top management. The target was cascaded down to the key directors and managers under whom the implementation of the system fell. This stemmed out user resistance, lack of resources, slow procurement processes and negative organizational politics.

A steering committee comprised of directors and senior managers was formed which oversaw the development and implementation of the system. A project champion to chair the steering committee was appointed by the Director General. Open communication channels were established between the steering committee, user departments and the implementation team. The implementation team that was formed was accorded full support from the management and all the resources required were availed. The team was made up of staff from IT and user departments. Infrastructure requirements were addressed by purchase of servers, upgrading of internet bandwidth and installation of dedicated WAN links. The development and implementation team were promised rewards by the management of KCAA once the system was live and fully operational. This made the team work dedicatedly. During the complex tasks like system analysis, design and coding, the team would go on a retreat and get the work done from a serene environment.

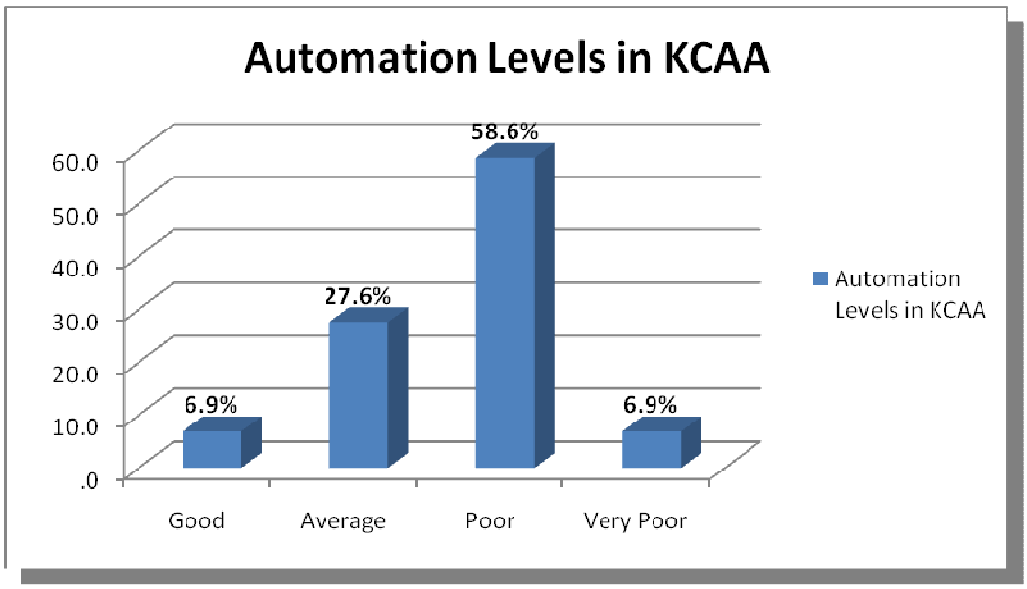
To address the problem of changing requirements, the implementation team did a thorough requirements collection exercise from all the stakeholders. The main users from each department analyzed the requirements, prepared work flows and the expected reports. The requirements were reviewed and all key users committed on the final system analysis and design document and the project charter through sign offs. With frozen

requirements, the target was fixed, the expectations were clearly communicated and understood by the stakeholders. This gave the implementation team good environment to develop and implement the system. The conflicts that existed earlier between the air transport department, the AIS and ATS departments were also comprehensively addressed.

4.7 Improving Automation Levels in Aviation Regulation

The study sought out to establish how automation levels can be improved in the aviation regulator. Regarding the automation levels, the respondents were asked to rate the automation levels in KCAA. As illustrated in figure 5, 58.6% of the respondents felt that the automation levels in the Authority were poor while 27.6% recorded average automation levels.

Figure 6 : Automation levels in KCAA



Source : Research data, 2012

The poor automation levels can be attributed to various reasons which the study sought to establish. Respondents pointed out that the Organizational culture contributed a lot to lack of automation. This is because most of the employees in the Authority felt that they were extremely knowledgeable and experienced in their areas with the manual processes

and automation will take away that edge. Other respondents blamed the high oversight and audits the Aviation industry gets from ICAO and FAA. A lot of emphasis is given to establishment of manual processes and paper work. The respondents said that ICAO, FAA and other international aviation oversight bodies should insist on automated processes from the Civil Aviation Authorities they oversee. The safety and security compliance checklists from ICAO should have low automation levels as some of the necessities for compliance. The following sections were highlighted to urgently need automations; billing and revenue management, sourcing, airworthiness, flight operations, licensing, external flight planning and the East African school of aviation.

The fact that the Authority either lacks an ICT policy or it is existent but not known, enforced or implemented was raised by the respondents. The ICT policy should be revised in tandem with the latest developments in the industry. It should be approved by the board of directors and operationalized. Respondents mainly from the ICT department replied that the department is not well established given that it is the newest department in the Organization. Some of the functions of the department are carried out by other departments like engineering and AIS who lack the required expertise in improving business processes through the use of ICT. They felt that the department should be empowered, allocated more funds and its structure revised. Respondents also expressed their concerns on the continuity of operations if a catastrophic disaster was to happen to the main KCAA headquarters. This was because of unavailability of any remote disaster recovery site or procedures.

Most processes within the aviation regulation are hardly automated. The study sought to establish what system acquisition methods the respondents thought was the best for the Organization. The main system acquisition methods i.e. in-house development, buy and customize and outsourcing were listed in a likert scale with values from 1=not preferred, 2=least preferred, 3=moderately preferred, 4=highly preferred and 5= very highly preferred. As illustrated in table 6 below, most respondents had faith in in-house

development with a mean of 4.3. Outsourcing had a mean value of 2.1. Buying and customizing was moderately preferred with a mean of 3.6. However, the standard deviation of more than 1 means that the levels of consensus were low. The respondents had faith in in-house development because it is the method that was used to acquire the AATIS.

Table 6 : Information system acquisition methods

Information System acquisition method	N	Min	Max	Mean	Std. Dev.
In-house	29	3.00	5.00	4.3103	0.76
Buy and Customize	29	2.00	5.00	3.6207	1.01
Outsourcing	29	1.00	5.00	2.1724	0.89

Source : Research data, 2012

Regarding the automation of adhoc landing and overflight permits in other airspaces, only 4 respondents respondent positively. The civil aviation authorities mentioned were United Arab Emirates General Civil Aviation Authority and the European Airspace.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter summarises and makes conclusions on the findings of the study in relation to the objectives as indicated in Chapter One. It also discusses the value of the study, its limitations and recommendations for further research.

5.2 Discussion of findings

The major objective of the study was to establish the challenges encountered in development and implementation of information systems in aviation regulation. The study focused on the challenges faced in the development and implementation of the AATIS which automated processing of landing and overflight permits in the Kenyan airspace. The major stages in implementation of information systems were summarized into two major phases; development and implementation according to Ralph and Reynolds (2008), O'Brien (2007) and Kendall and Kendall (2006).

The study established that the major challenges that were experienced in the development of the AATIS were bureaucracies in Government projects, organizational politics, slow procurement processes, schedule overruns, poor change management practices, poor requirements management, inability to retain technical staff and poor attitudes towards quality improvement. Other common challenges in development of information systems like user comfort zones, technical staff comfort zones, quick technology advancements, inadequate system testing and high cost of licences were not encountered. During the implementation phase of the AATIS, the major challenges were poor IT infrastructure specifically in internet services, WAN connectivity and computers, bureaucracies in Government projects, conflicts between user departments, slow procurement processes, regulatory frameworks and schedule overruns. The implementation of AATIS did not

face challenges like budget overruns, difficulties in conversion of data, high cost of licences, lack of resources, design and usage gaps in technology and inadequate system testing. The study also established that the automation levels in the Kenyan aviation regulation are very poor even with the automation of adhoc landing and overflight permits. Organizational culture, user comfort zones, manual oversight procedures, lack of a proper and well established ICT policy, conflicts between the main technical departments and lack of disaster recovery site and procedures has led to low automation levels in KCAA. The automation levels in other civil aviation authorities in relation to adhoc landing and overflight permits is also extremely low.

5.3 Conclusion

The challenges that were faced during the automation of landing and overflight permits in the Kenyan aviation regulation are also inherent in most Kenyan Parastals and civil aviation authorities. The findings are in agreement with a study done by Borura (2009) and Tesch et al (2007). The key challenges beleaguering implementation of information systems are mainly people and processes management. The challenges of bureaucracies in Government projects, organizational culture and politics and slow procurement processes have been established in information system studies but they are still prevalent.

In the highly regulated civil aviation sector, automation is not emphasized enough and its potential in management and oversight of safe skies is overlooked. The international aviation oversight bodies like the International Civil aviation Authority (ICAO) and the Federal Aviation Administration (FAA) have put laid out procedures that promote manual operations in the aviation regulators. Key sections in aviation regulation also find have conflicts that affect implementation of information systems. These sections are air traffic control, aeronautical information services and economic regulation.

5.4 Recommendations

To increase the success and levels of implementation of information systems in Kenyan Government institutions, the Government should emphasize on use of computerized information systems. Each year, performance contracts in the public sector are set between Government institutions and their parent ministry. Evaluation of performance against set targets is done each year to establish the performance of the institutions and their respective ministries. Automation of various processes should be a key component in these performance contracts. Increase in automation levels should be mandatory and based on number of information systems projects successfully implemented.

Empowerment of IT departments should also be part of the performance contract for each Ministry and the Government institutions under it. The budget of the IT departments should me made a standard percentage of an institutions' budget. Compliance to and full utilization of this budget should be evaluated annually. Particular emphasize in the performance contracts for each institutions should be its procedures for disaster recovery and business continuity in case of a catastrophic event. The ISO certificates issued by various bodies within the Country should emphasize on provision of basic services through computerized information systems as part of conformity and continual improvement. The Procurement Act should be reviewed to include mandatory use of computerized information systems in public procurement. This will improve the quality of work done, accountability and transparency.

In aviation regulation, ICAO annexes which govern the Standards and Recommended Practises (SARP) should be modified to include automated procedures. This will force Civil Aviation Authorities to prepare their State operation manuals and procedures with automation in mind. Aviation bodies like the FAA who do audits in various States should insist on fully computerized aviation personnel licencing, economic regulation, aircraft registration, automated flight operations and airworthiness checklists. Use of Manual

procedures in these sections should be viewed as non-compliance. Strategic plans for Regional Civil Aviation bodies like EAC CASSOA should include harmonization of regional procedures and documents with computerization as the main facilitator. ICAO should promote innovative ideas from States like the AATIS in Kenya to the other ICAO Contracting States

5.5 Limitations of the study

The major limitation in this study was getting more time to engage some of the respondents in management positions. They were extremely busy given that they are senior personnel and the data was being collected during an FAA compliance audit. The Civil Aviation Authority is also in between a commission of enquiry because of a major aircraft accident. Due to this, some targeted respondents who are involved with the commission did not respond.

5.6 Suggestion for further studies

The following study areas will be important for further research; A study on the impact of the AATIS among the Kenyan aviation stakeholders, a comparative study on the performance of interstate adhoc landing and overflight clearances in the Eastern African Region, an assessment of the benefits of automated civil aviation oversight processes on the aviation industry in reference to aircraft accidents, incidents, air traffic growth and aviation consumer satisfaction in Africa.

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APPENDICES

APPENDIX I: QUESTIONNAIRE COVER LETTER

Thomas Kivuva
P.O. Box 30163-00100
Nairobi-Kenya
Tel. 0722241006
thomaskivuva@gmail.com
22-September-2012

Dear Sir/Madam

RE: Data collection for MBA Research Project

My name is Thomas Kivuva, a postgraduate study undertaking a Master of Business Administration (MBA) degree at the School of Business, University of Nairobi. As a partial fulfillment of the requirements for the award of the MBA degree, I am currently conducting a study on the "**challenges in development and implementation of information systems in adhoc landing and overflight clearances in the Kenyan Airspace**".

I kindly request for your valuable time in assisting to complete the attached questionnaire. The research is intended to outline the challenges faced in development and implementation of the KCAA Advanced Air Transport Information System (AATIS). The findings of the study will be important in addressing the automation challenges faced in aviation regulation.

The information provided in the questionnaire will be treated with utmost confidentiality and will not be used for any other purpose apart from its intended academic use.

Thank you.

Yours faithfully

Thomas Kivuva

APPENDIX II: QUESTIONNAIRE

This questionnaire is meant to collect information on the Challenges in development and implementation of information systems in adhoc landing and overflight clearances in the Kenyan Airspace. Kindly answer the questions by ticking the boxes where appropriate and writing brief statements in the spaces provided where applicable. Thank you in advance.

Part A: Respondents' Profile

1. Age Group

< 30	[ ]
31 - 35	[ ]
36 - 40	[ ]
41 - 45	[ ]
46 - 50	[ ]
51 - 55	[ ]
> 55	[ ]

2. How many years have you worked for KCAA/DCA?

< 5	[ ]
5 - 10	[ ]
11 - 15	[ ]
16 - 20	[ ]
> 20	[ ]

3. Gender Male [ ] Female [ ]

4. What is your highest level of education?

Secondary Education	[ ]
Professional Certificate	[ ]
Diploma	[ ]
First Degree	[ ]
Post Graduate Degree	[ ]
Other	[ ]

If other, please specify.....

5. What is your Position in the Organization?

Director/Manager	[ ]
Chief	[ ]
Senior	[ ]
Officer 1/2/3	[ ]
Other	[ ]

If other, please specify.....

6. Which Station are you in?

Headquarters	[ ]
Jomo Kenyatta International Airport (JKIA)	[ ]
Wilson Airport (WAP)	[ ]
Moi international Airport (MIA)	[ ]
Other	[ ]

If other, please specify.....

7. Which department are you in?

ICT	[ ]
Air Transport	[ ]
Aeronautical Information Services (AIS)	[ ]
Air Traffic Services (ATS)	[ ]
Other	[ ]

If other, please specify.....

Part B: Challenges in the development of the AATIS

8. How were you involved in the development of the AATIS?

Member of steering committee	[ ]
Member of the implementation team	[ ]
Involved as a user of the system	[ ]
Other	[ ]

If other, please specify.....

9. Which stages were you involved in during development of the AATIS?

System Inception	[ ]
Requirements collection	[ ]
Systems Analysis	[ ]
System Design	[ ]
System Coding	[ ]

If others, please specify.....

10. What was your main role in each of the stages you were involved in development of the AATIS?

System Inception .....

.....

Requirements collection .....

.....

Systems Analysis.....

.....

System Design.....

.....

System Coding.....

.....

If there are other roles you played, please specify .....

.....

11. To what extent did you encounter the following challenges during the development of the Advanced Air Transport Information System. Use the ranking guideline below.

[1-No Extent 2- Little Extent 3-Moderate Extent 4-Great Extent 5-Very Great Extent]

	CHALLENGE	**1**	**2**	**3**	**4**	**5**
1.	Lack of user participation					
2.	Lack of commitment from top management					
3.	Lack of support from top management					
4.	Poor project management					
5.	Poor requirements management					
6.	Lack of technical expertise and skills in developers					
7.	Poor change management					
8.	Communication barrier					
9.	Budget overruns					
10.	Schedule overruns					
11.	Corruption					
12.	Bureaucracies in Government projects					
13.	Slow procurement processes					
14.	Inability to retain technical staff					
15.	Insufficient software evaluation					
16.	Organizational politics					
17.	Poor attitude towards quality improvement					
18.	User comfort zones					

19.	Technical Staff Comfort zones					
20.	Quick technology advancements					
21.	Inadequate system testing					
22.	High cost of licences					

12. Did you encounter any other challenges in the development besides the ones above?

    Yes [ ] No [ ]

    If yes, please briefly explain.....

    .....

13. For the challenges that were encountered in development, please explain how they were resolved or mitigated?

    .....

    .....

Part C: Challenges in implementation of the AATIS

14. How were you involved in the implementation of the AATIS?

    Member of steering committee [ ]
    Member of the implementation team [ ]
    Involved as a user of the system [ ]
    Other [ ]
    If other, please specify.....

15. Which stages were you involved in during implementation of the AATIS?

    Installation [ ]
    Customization [ ]
    User and technical training [ ]
    User acceptance testing [ ]
    System Conversion [ ]
    Support and maintenance [ ]
    If others, please specify.....

16. What was your main role in each of the stages you were involved in implementation of the AATIS?

    System Installation .....

    .....

    Customization.....

    .....

User and technical training.....

.....

User acceptance testing .....

.....

System Conversion .....

.....

Support and maintenance .....

.....

If there are other roles you played, please specify .....

.....

17. To what extent did you encounter the following challenges during the implementation of the Advanced Air Transport Information System. Use the ranking guideline below.

[1-No Extent 2- Little Extent 3-Moderate Extent 4-Great Extent 5-Very Great Extent]

	CHALLENGE	**1**	**2**	**3**	**4**	**5**
1.	Lack of resources					
2.	Lack of commitment from top management					
3.	Lack of support from top management					
4.	Poor project management					
5.	Lack of technical expertise and skills					
6.	Poor IT infrastructure - Computers					
7.	Poor IT infrastructure - Local Networks					
8.	Poor IT infrastructure - Internet and WAN Links					
9.	Poor change management					
10.	Communication barrier					
11.	Budget overruns					
12.	Schedule overruns					
13.	Conflict between user departments					
14.	Corruption					
15.	Bureaucracies in Government projects					
16.	Slow procurement processes					
17.	Design and usage gaps in technology					

18.	Design and usage gaps in staffing					
19.	Design and usage gaps in processes					
20.	Regulatory frameworks					
21.	Organizational politics					
22.	Poor attitude towards quality improvement					
23.	User comfort zones					
24.	Lack of IT Skills from users					
25.	Technical Staff Comfort zones					
26.	Quick technology advancements					
27.	Inadequate system testing					
28.	Difficulty in data conversion					
29.	High cost of licences					
30.	Information security issues					

18. Did you encounter any other challenges in the implementation besides the ones above? Yes [ ] No [ ]

    If yes, please briefly explain.....

    .....

19. For the challenges that were encountered in development, please explain how they were resolved or mitigated?

    .....

    .....

Part D: Understanding and Improving the automation levels in KCAA

20. How would you rate the level of automation in KCAA?

    Very Good [ ] Good [ ] Average [ ] Poor [ ] Very Poor [ ]

    Explain.....

    Besides the challenges experienced in the development and implementation of the AATIS, which other factors hinder implementation of information systems in KCAA?

.....

.....

.....

.....

21. Which ways would you propose that would improve the development and implementation of information systems in KCAA?

.....

.....

22. To what extent would you prefer to use each of the following system acquisition methods listed below in acquisition of information systems in KCAA? Use the ranking guideline below.

[1-Not preferred 2- Least Preferred 3-Moderately Preferred 4-Highly Preferred 5-Very Highly Preferred]

	Information System acquisition method	**1**	**2**	**3**	**4**	**5**
1.	In-house development					
2.	Outsourcing the development					
3.	Buying fully developed systems and customizing					

23. Are there other Information System acquisition methods you would recommend for use in KCAA or other CAAs? Yes [ ] No [ ]

If yes, please explain.....

.....

.....

.....

24. Which other areas in KCAA need implementation of information systems?

.....

.....

.....

.....

25. Are there other civil aviation Authorities that have automated adhoc landing and overflight permits? Yes [ ] No [ ]

If yes, please list them.....

.....

.....

26. Are the experiences from the process of automating the adhoc and landing permits in KCAA useful to other Civil Aviation Authorities and bodies?

.....

.....

.....

Thank you for your responses.